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SEPTEMBER, 1939

# FACTORY

## MANAGEMENT and MAINTENANCE

A McGRAW-HILL PUBLICATION

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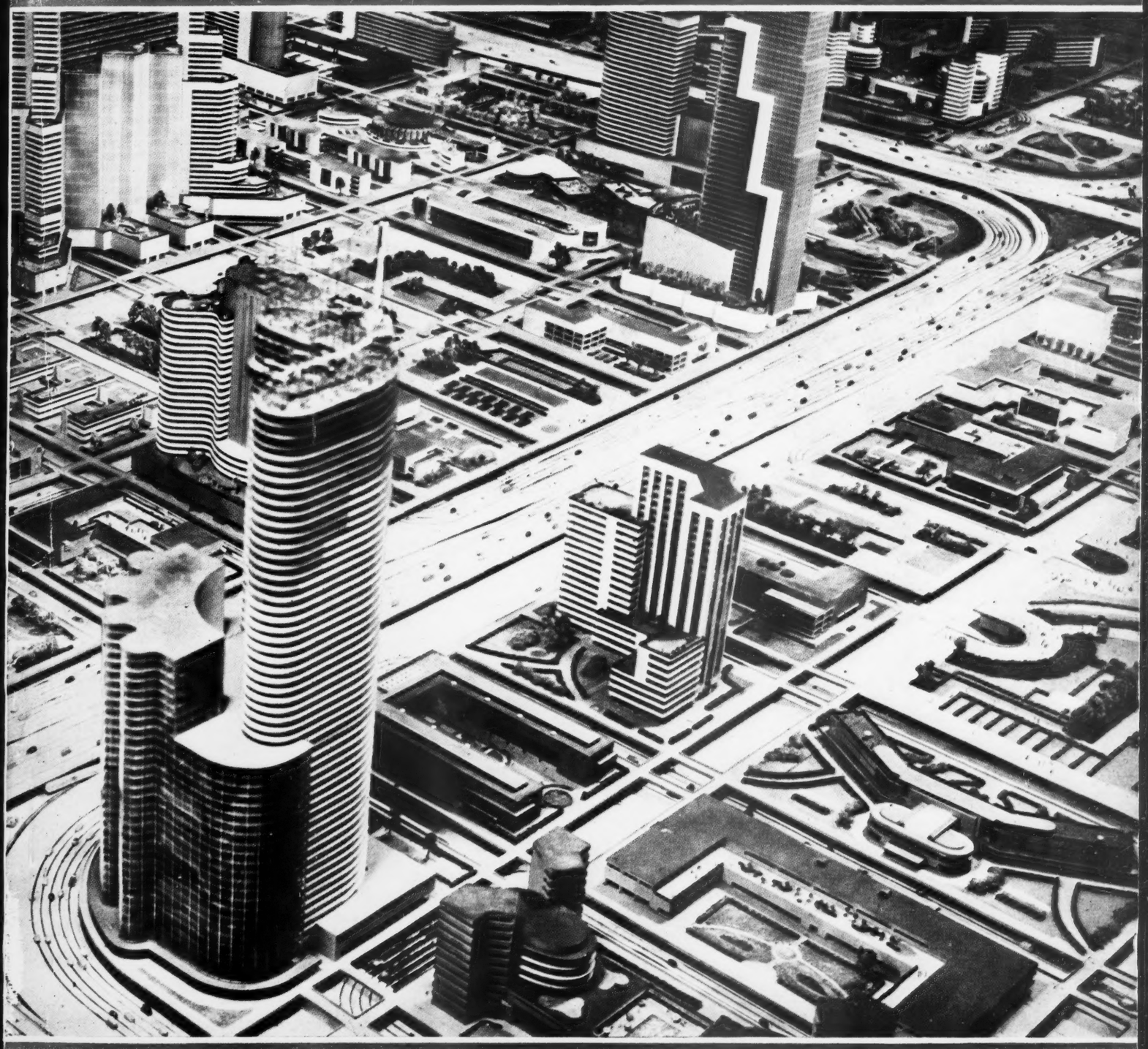

## THE INDUSTRIAL TOWN OF TOMORROW

(FROM THE HUMAN RELATIONS VIEWPOINT)

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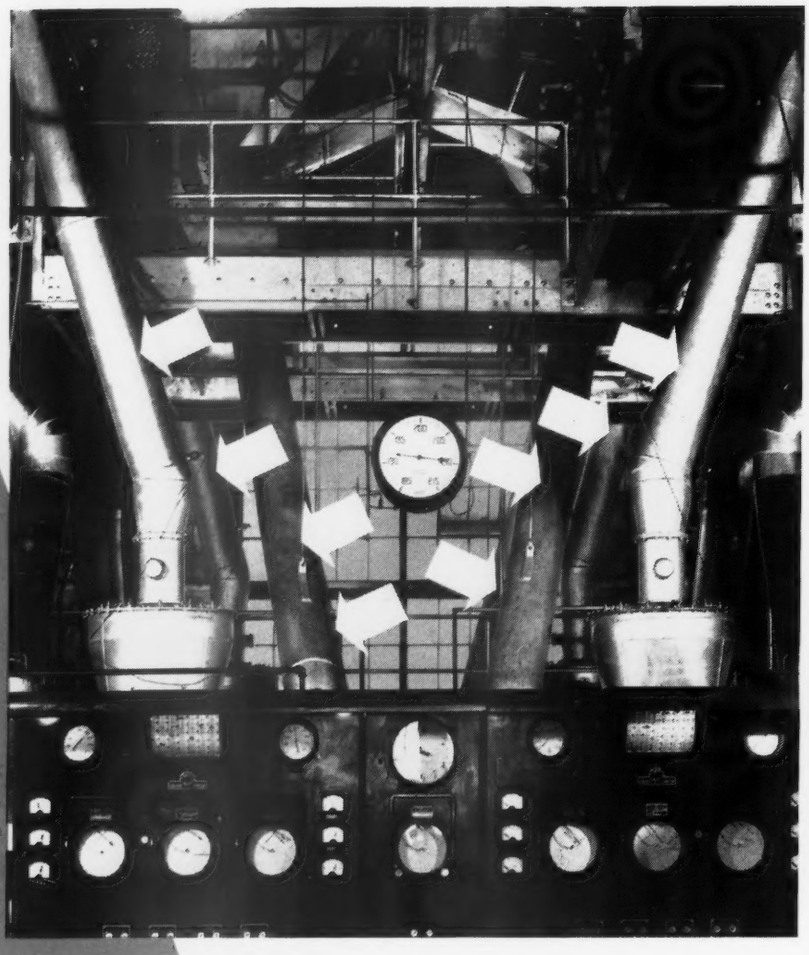
CORROSION
COSTS YOU MORE THAN
WROUGHT IRON

**Especially where Low-Grade Fuels Accelerate Corrosion**



# *Use* BYERS WROUGHT IRON

Increasing use of low-grade fuels, made possible by improved combustion equipment and control, has brought a serious problem to the maintenance engineer. Sulphur compounds render the coal, its ashes, and its combustion products all highly corrosive.

The illustration shows one plant's solution of this problem. The eight coal chutes indicated are 16" OD Byers Wrought Iron pipe. Additional pipe is used for drainage lines from the ash pits.

Service records on wrought iron smokestacks that have lasted thirty to forty years first suggested the use of wrought iron for fuel-handling equipment. Today dozens of industrial plants use it for this purpose. Many railroads use wrought iron in all parts of their coaling stations that are subject to marked corrosion. Coal larry hoppers, economizers, pre-heaters, breechings, and similar equipment are made of wrought iron to reduce repair and replacement costs.

The boiler room is only one of hundreds of places where corrosion costs you more than wrought iron. If you want to check on the savings the use of wrought iron can bring, just write us the details of your problem. Our Engineering Service Department will (1) Determine the probable corrosive conditions; (2) Relate these to similar conditions encountered elsewhere; (3) Interpret the results in the light of 75 years' experience with corrosion problems; and (4) Make recommendations . . . supported by service records. Ask, too, for a complimentary copy of our bulletin, "Wrought Iron for Flue Gas Conductors and Coal Handling Equipment."

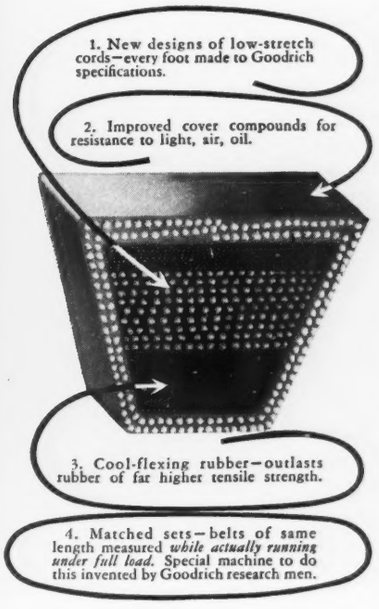
A. M. Byers Co., Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Chicago, St. Louis, Houston, Seattle, San Francisco.

## BYERS GENUINE WROUGHT IRON

**TUBULAR AND FLAT ROLLED PRODUCTS**

**Specify Byers Genuine Wrought Iron Pipe for corrosive services and Byers Steel Pipe for your other requirements**

*Recent Improvements in Goodrich V-Belts*


1. New designs of low-stretch cords—every foot made to Goodrich specifications.
2. Improved cover compounds for resistance to light, air, oil.
3. Cool-flexing rubber—outlasts rubber of far higher tensile strength.
4. Matched sets—belts of same length measured *while actually running under full load.* Special machine to do this invented by Goodrich research men.

# Goodrich takes temperature of rubber so your belt costs will go down

## *One important reason Goodrich V-Belts run longer and better is that they operate 75% cooler*

INTERNAL heat is what destroys belts as it does tires. Goodrich engineers worked for years on cool-flexing rubber compounds. Each was made into belts, run, and its temperature taken. Finally a compound was developed that operates 75% cooler than former belts — at this new low temperature the rubber keeps its flexibility, cords retain their strength, belts last far longer. Every Goodrich V-Belt today is made with this improved cool-flexing, long-lived rubber.

MR. BELL, WHY DO SOME BELTS IN A SET GET LOOSE WHILE OTHERS ARE TIGHT
AFRAID THEY AREN'T MATCHED VERY WELL, JIM. NEXT TIME WE'LL GET GOODRICH TENSION-MATCHED SETS

### *Other important improvements*

More reasons why Goodrich V-Belts will help you cut belting costs are shown in the diagram above. These and other improvements made in recent years explain why modern Goodrich V-Belts prove in tests to have many times the life of belts of a few years ago. If you have not used Goodrich V-Belts recently, by all means order a set now, put them on your toughest drive, and see how remarkably they have improved over any belt you ever knew, even a short time ago.

### *What it means to you*

The longer life of Goodrich V-Belts assures lower belting cost, more and steadier production, saving of time, trouble, expense formerly required by frequent plant shut-downs for belt replacement. And Goodrich matched sets — which make sure every belt in a set carries its full share of load — makes the set wear evenly and so last longer.

### *Start saving now*

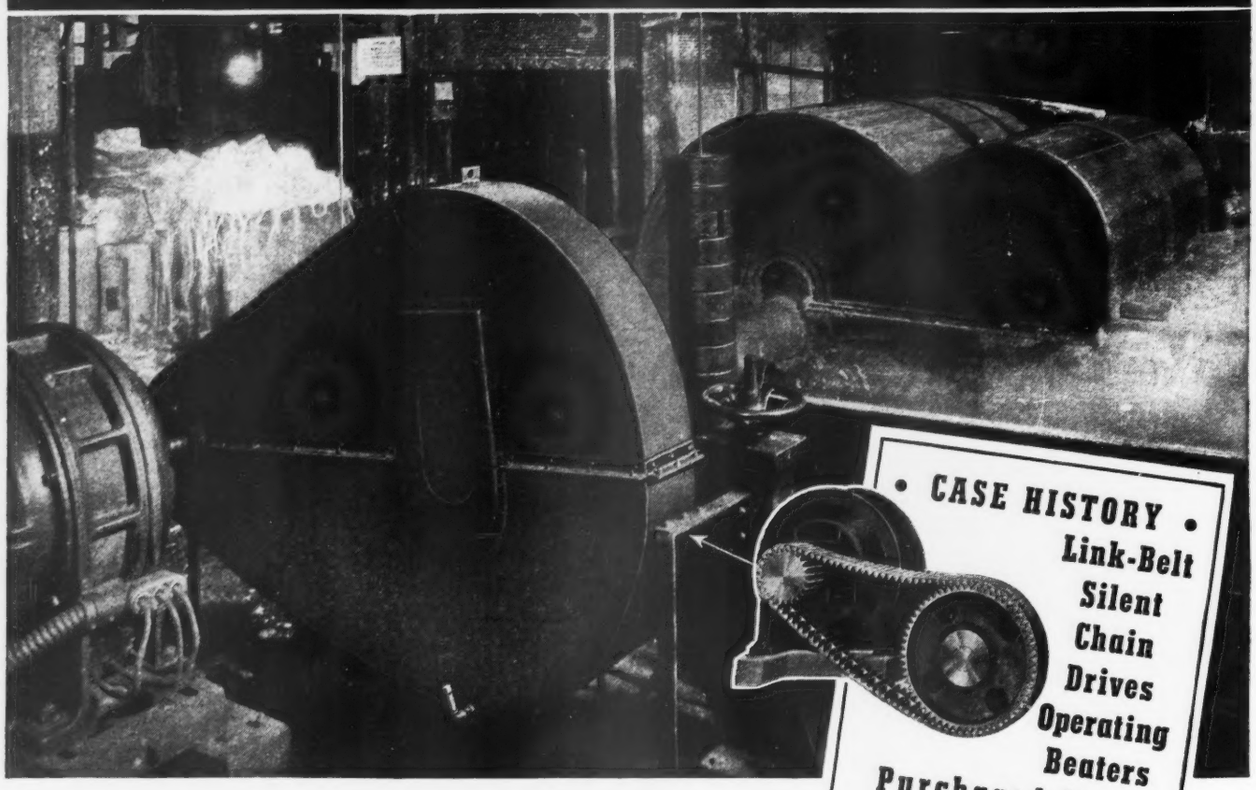
Thousands of plants are saving money with the new, improved Goodrich V-Belts. Call your Goodrich Distributor and let him show you how these belts will save for you, too. The B. F. Goodrich Company, Mechanical Rubber Goods Division, Akron, Ohio.

**Goodrich**

***cool-running, tension-matched***

**V-Belts**

# SILENT CHAIN PERFORMANCE FACTS



• CASE HISTORY •
Link-Belt Silent Chain Drives Operating Beaters Purchased 1920
W. C. Hamilton & Sons
Miquon, Pa.

## 19 YEARS..Practically No Upkeep And Still Operating At High Efficiency!

● The Link-Belt Silent Chain Drive illustrated above is only one of many working day and night at the paper mill of W. C. Hamilton & Sons, Miquon, Pa. This drive and four others were installed in 1920 and, because of their exceptional performance, over 35 other Silverstreak Silent Chain Drives have been purchased by this organization.

No other type of power transmission equipment can equal the economy and efficiency of the Silverstreak Silent Chain Drive. Low first cost, low maintenance expense, high power-delivery efficiency and faithful performance for 10, 20, 30 years and longer assure positive savings.

Get the complete facts—write today for Engineering Data Book No. 125. Also for special books covering all or any of the complete line of Link-Belt positive drives illustrated below.

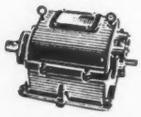
Link-Belt Company, Indianapolis, Chicago, Philadelphia, Atlanta, San Francisco, Toronto. Branch offices and distributors in all principal cities. 7822

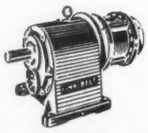
1939
NEW YORK WORLD'S FAIR EXHIBITOR METALS BLDG.

ROLLER CHAIN DRIVE

P.I.V. GEAR SPEED VARIATOR

V.R.D. VARIABLE ROLLER DRIVE

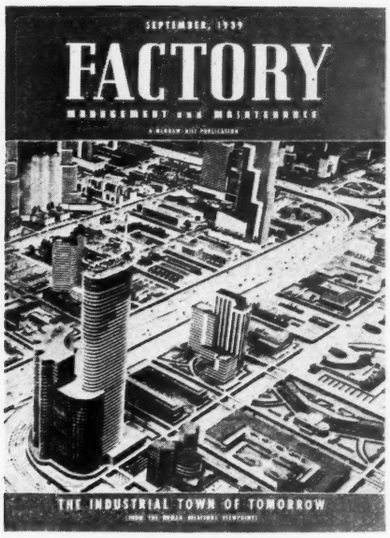

HERRINGBONE GEAR REDUCER


MOTORIZED REDUCER

WORM GEAR REDUCER

# LINK-BELT

## SILVERSTREAK SILENT CHAIN DRIVES




FACTORY continues its series of 4-color cover photographs with a "shot" of the Town of the Future as visualized by Norman Bel Geddes in the General Motors Highways and Horizons exhibit at the New York World's Fair. It ties in nicely, as it happens, with this month's leading article, "The Industrial Town of Tomorrow," which, however, leaves physical appearance to Mr. Geddes and is written solely from the human relations viewpoint. The photograph was taken from the same conveyor from which the world of 1960 is viewed daily by thousands of Fair visitors. Kodachrome by a McGraw-Hill staff photographer.

●

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# FACTORY

MANAGEMENT and MAINTENANCE

SEPTEMBER, 1939

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# DEVELOPED THROUGH RESEARCH

Ball bearings can do with very little lubrication, but that little must be right! Gulf scientists use this machine to determine the best lubrication practice for ball bearings operating under a wide variety of speed and load conditions.

More than 30 pressure taps have been applied to this rotary pump—a practical test used to find out what oil is best to lubricate certain types of bearings. Thus lubricants suited to specific operating conditions can be recommended.

With the device above, Gulf scientists determine what lubricants have the proper character to withstand conditions found in oscillating parts. Careful measurements are made of temperature rise, wear, corrosion, etc.

# AND *Proved in Service*

"We get better production from our spinning frames with Gulfgem Oil," says the superintendent shown above in consultation with a Gulf engineer. Mill men everywhere report better operation with Gulf's higher quality lubricants.

"The valves in this compressor had to be cleaned once a week and frequently replaced," says this power plant engineer. "But since we've standardized on Gulf's higher quality lubricants our operating troubles are ended."

"We have a $100,000 investment in this dredge," says this captain, "and we are insuring continuous operation by the use of Gulf quality lubricants. Shutdowns cost us about $35.00 an hour, and we must insure ourselves against them."

## Gulf's higher quality lubricants help increase the productivity of *all types* of machinery!

**Oils with greater stability permit higher machine speeds, withstand higher temperatures, greater pressures .... and help you preserve profit margins!**

LABORATORY research determines what properties lubricants must possess to meet specific operating conditions. Practical service in the field confirms the value of this technical research.

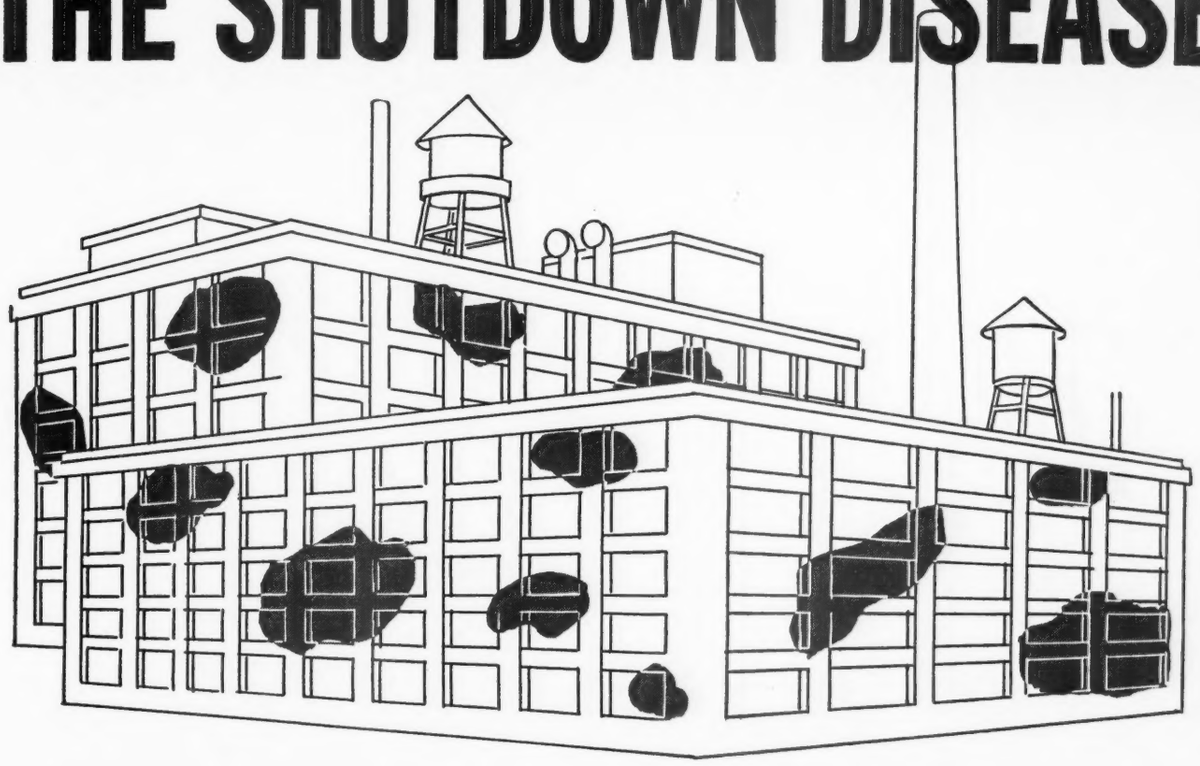
But what does that mean to the user of industrial oils, you ask? Simply this: *You play safe* when you use Gulf's higher quality lubricants — because *they are both scientifically developed and proved in service!* Users everywhere report smoother machine operation, greater productivity, and lower operating costs after they have had their equipment checked over by an experienced Gulf lubrication engineer, and adopted his recommendations.

Gulf offers this cost-saving lubrication service to public utilities, railroads, industrial and marine operating companies without charge. More than 1100 Gulf warehouses in 28 states from Maine to Texas make these higher quality oils and greases quickly available to you. Write or phone your nearest distributing point today.... Gulf Oil Corporation — Gulf Refining Company, Gulf Building, Pittsburgh, Pa.

GULF INDUSTRIAL LUBRICATION

A COMPLETE LINE OF MORE THAN 400 QUALITY OILS and GREASES for INDUSTRY

# THE SHUTDOWN DISEASE



# can attack any factory!

Your factory may be suffering from the *Shutdown Disease* without your realizing it.

Chronic shutdowns are not usually spectacular. A motor here . . . a few machines there. *But the costs add up.*

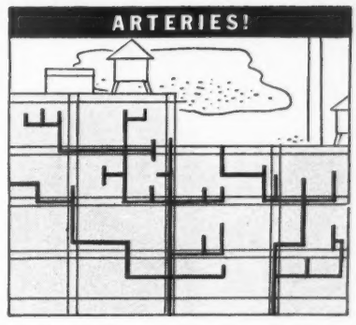
In too many factories, shutdowns come to be taken as a matter of course. They are forgotten too soon . . . and happen again too often. In the course of a year their *total* cost can cut sharply into profits.

Yet, like many other diseases, the *Shutdown Disease* can be cured and prevented.

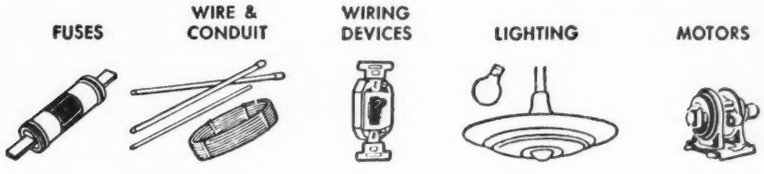
If the shutdown is an electrical one, there is a quick and easy *cure.* Call your Electrical Contractor or if you do your own installing call your nearby Graybar warehouse. You'll find it well-stocked with all the electrical items you are likely to need. Graybar trucks are ready to deliver the needed items . . . quickly . . . conveniently.

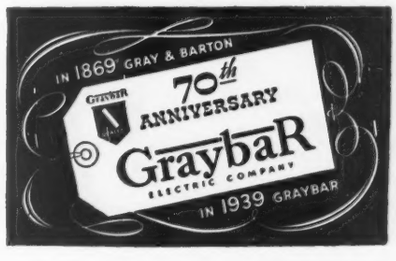
At the same time Graybar can help you *prevent* shutdowns...by providing the kind of reliable products that stand up on the job year after year.

Graybar's service of supplies is *keyed* to your needs . . . to save you money. Investigate! Ask a Graybar salesman—or write to the Graybar Electric Company, 420 Lexington Ave., New York, N. Y.




The wires that run through the raceways under your floors or through the walls are the *arteries* that keep your plant alive. Their failure results in Shutdowns. Be sure they are right to take care of today's needs. A survey of wiring costs nothing—saves much.

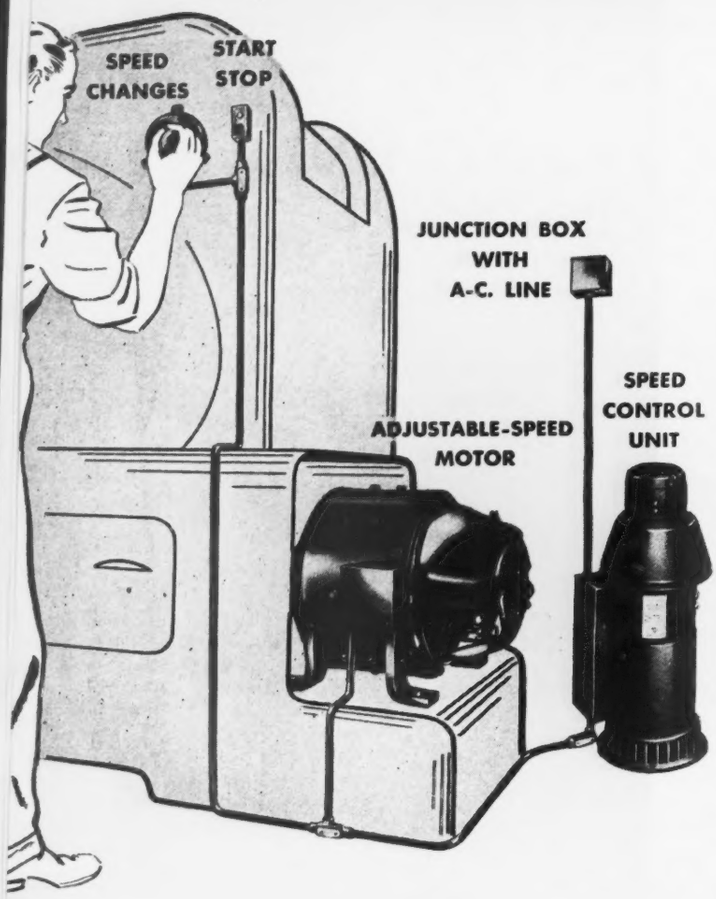



OFFICES IN 83 PRINCIPAL CITIES • EXECUTIVE OFFICES: GRAYBAR BUILDING, NEW YORK, N. Y.

# AN ALL-ELECTRIC ADJUSTABLE-SPEED DRIVE FOR ALTERNATING-CURRENT CIRCUITS...

**Now makes available in economical form for sizes 1 to 15 hp. a proven principle of speed control long used for large units**




You can do these things with this new Reliance Drive: (1) Apply power where you want it without intervening speed-changing devices . . . (2) Control speeds at any point to which a wire can be run, and do it from a speed changer no bigger than a pie plate . . . (3) Control starting and stopping from a small push-button station placed within easy reach.

Besides the advantages of wide speed ranges (12 to 1) and remote control you get other important features such as quick stopping, speed setting, safe speeds for threading and inching, ample starting torque for all conditions. All these are made possible at a lower price by the "packaged" V*S Speed Control Unit which is connected by three wires to the 3-phase a-c. power circuit. Of vertical construction, it takes little space and can be mounted anywhere.

**Reliance Electric & Engineering Company**
1070 IVANHOE ROAD CLEVELAND, OHIO

Birmingham, Boston, Buffalo, Chicago, Cincinnati, Detroit, Greenville (S. C.), Los Angeles, New York, Philadelphia, Pittsburgh, Portland (Ore.), St. Louis, San Francisco, Syracuse (N. Y.) and other principal cities.

**DESIGNERS... Please take note**

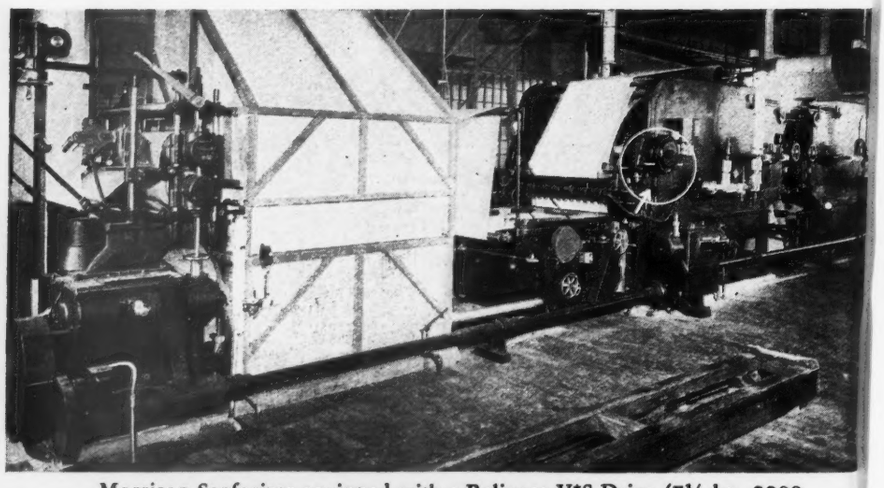
This new drive will help in "streamlining" your equipment by giving a direct, positive connection from the adjustable-speed motor to the machine. Speed adjuster and push-button take so little space that they can be grouped with other control handles for easy operation.

★ ★ ★

Produced by men who have specialized in adjustable-speed motor-drives for 34 years.

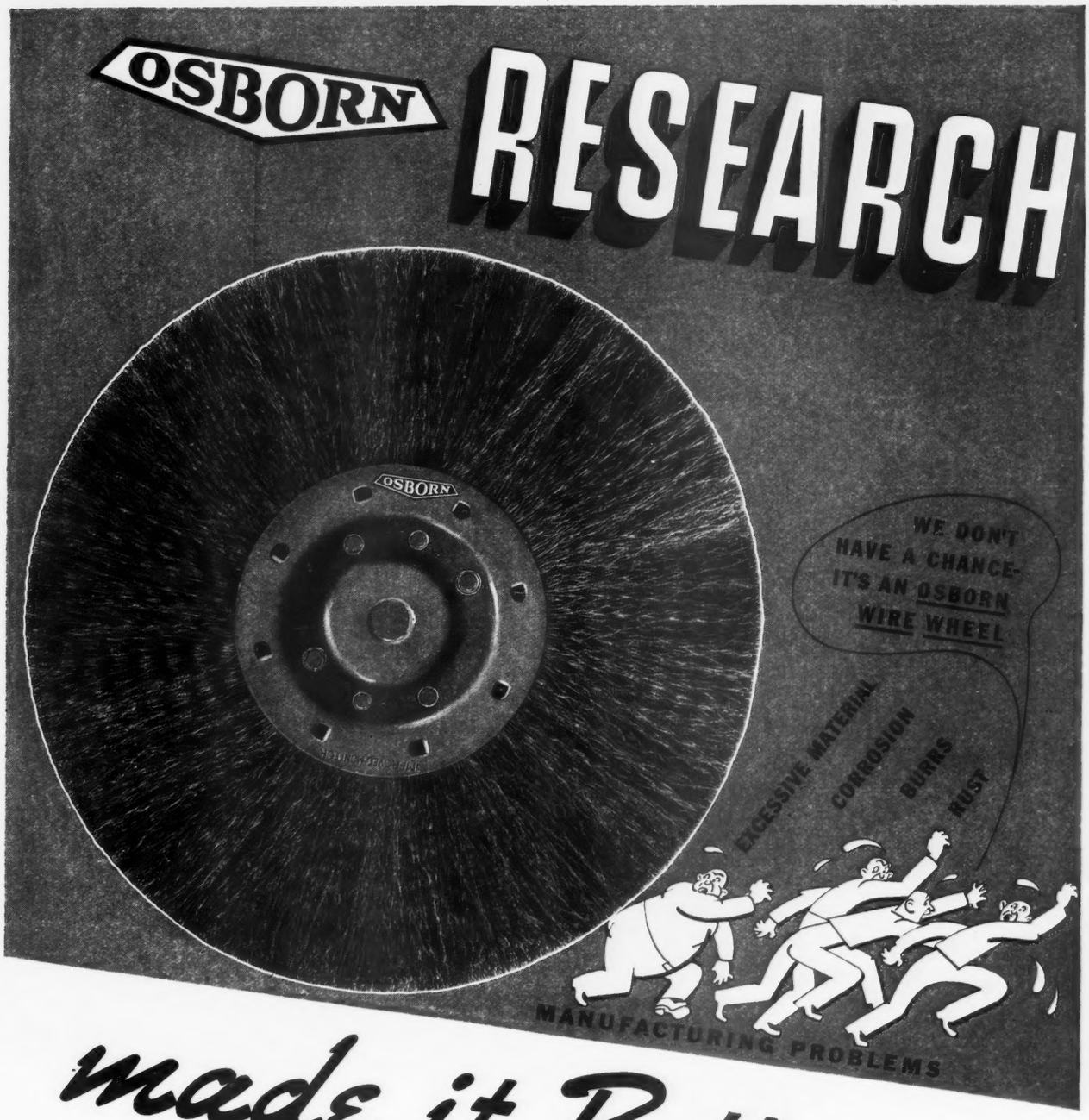
★ ★ ★

Get Bulletin 307 for details of the many desirable characteristics of this new drive.



Morrison Sanforizer equipped with a Reliance V*S Drive (7½ hp. 2200-218 rpm.). This application emphasizes the ease of providing for remote control of starting, stopping and speed changing. Push-button and speed adjuster are indicated by arrow; speed control unit and adjustable-speed motor are at the entry end of the machine on the left.

**RELIANCE A-C D-C MOTORS**

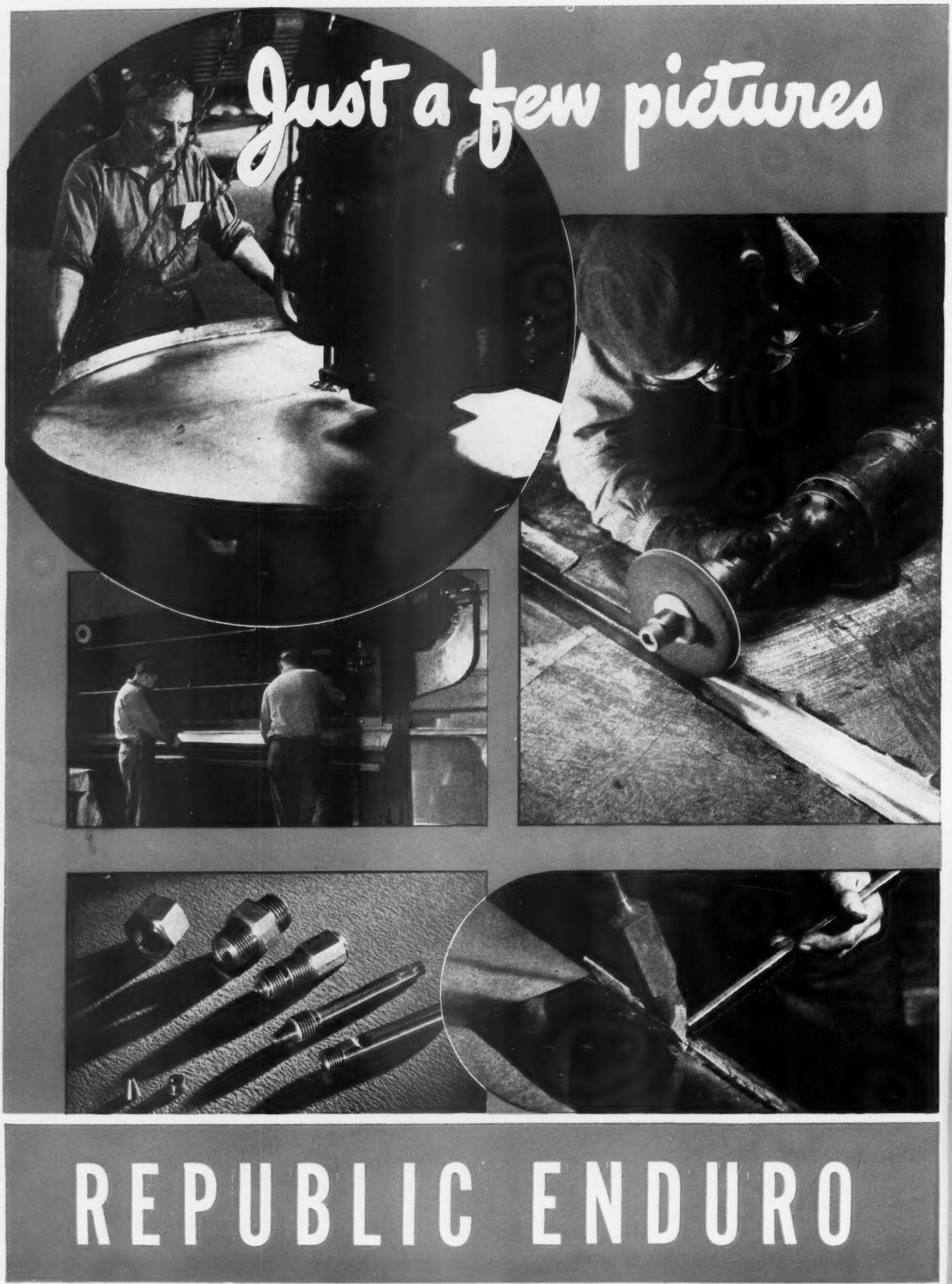



*made it Better...*

RESEARCH MAKES Osborn Brushes BETTER BRUSHES

Better balance, more strength, better performance and longer life make the Osborn Improved Monitor Steel Wire Section a leader in its class. Osborn Research keeps everlastingly at the job of making better brushes for American Industry.

THE OSBORN MANUFACTURING COMPANY • 5401 HAMILTON AVENUE • CLEVELAND, OHIO


Just a few pictures
REPUBLIC ENDURO

# to burst a bubble

**Showing how ordinary tools and intelligence ...combined with Republic ENDURO Stainless Steel...can be used to fabricate greater profits.**

The old idea that the fabrication of stainless steel involved almost insurmountable difficulties is a myth easily dispelled by these photographs. They show two things — the many ways in which articles of ENDURO* may be fabricated, and the use of machines in common use in plants everywhere, even to the lowly soldering iron.

But these photographs show even more. They show the making of articles which will soon pass into other hands at a profit to the manufacturer — because there is an active ready market for the better products that ENDURO makes possible.

This modern metal of silvery lustre beautifies homes and business establishments — serves well in institutions and industrial plants. It resists rust, corrosion, and high temperatures. It is sanitary and easily cleaned. It withstands hard service and abuse — and best of all, its cost is low when figured on the years of service it renders.

In Republic's world-renowned laboratories, metallurgists have developed ENDURO Stainless Steel in many types — for every conceivable service. Getting the correct type may mean the difference between the success and failure of your product. Republic can help you there — and will also send you a copy of the new book, "The Fabrication of Republic ENDURO Stainless Steel," upon request.

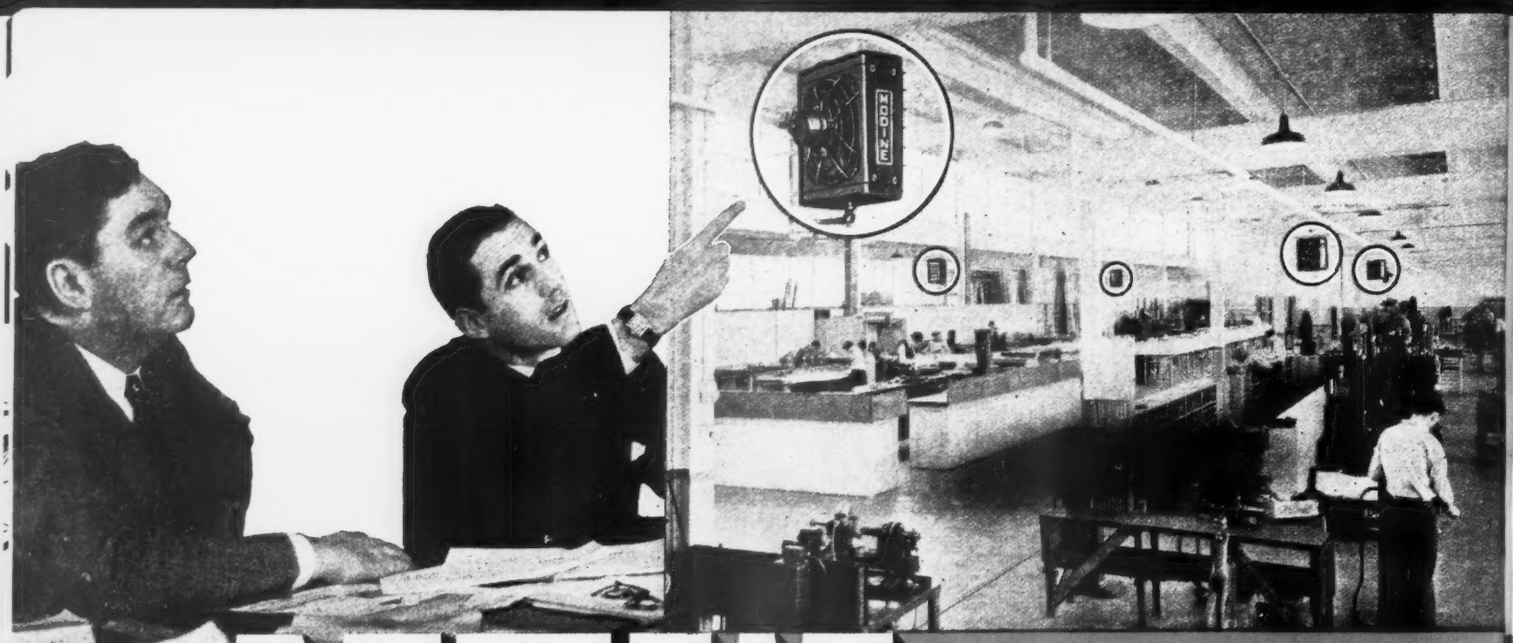
**REPUBLIC STEEL CORPORATION**
**GENERAL OFFICES • CLEVELAND, OHIO**
**ALLOY STEEL DIVISION • MASSILLON, OHIO**

*Reg. U.S. Pat. Off.

BERGER MANUFACTURING DIVISION
STEEL AND TUBES, INC.
TRUSCON STEEL COMPANY
NILES STEEL PRODUCTS DIVISION
UNION DRAWN STEEL DIVISION

REPUBLIC STEEL
REG. U. S. PAT. OFF.

***stainless and heat-resisting*** **STEELS**



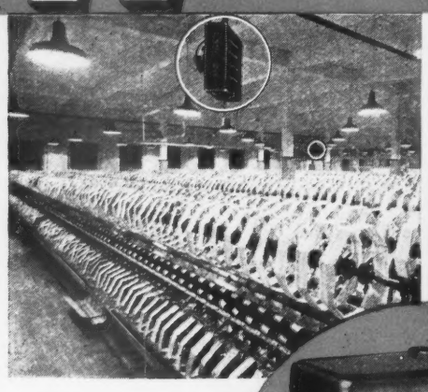

# *This* NEW MODINE UNIT HEATER

**THIS IS YOUR FIRST OPPORTUNITY IN SIX YEARS** to see a *NEW Modine* Unit Heater. And it is as distinctly different as it is thoroughly modern—the greatest value for your heating dollar that Modine or anyone else has ever offered.

For years Modine has led the field. *More Modines are purchased than any other unit heater.* Modine has pioneered the major unit heater developments in use today. And the New Modine has exclusive differences that will set new standards for the unit heater of tomorrow.

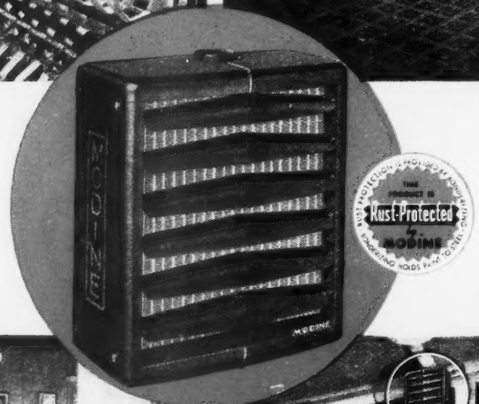
The New Modine has every modern feature of design—plus those time-tested, proven features that have enabled Modine Unit Heaters to establish an all-time heating performance record of more than a billion hours of satisfactory service.

As a result the New Modine Unit Heater is quieter in operation—more effective in fast, thorough, even heat distribution—more accurate in control—more economical to install, operate and maintain.



**FACTORIES**

**STORES**




**OFFICES**

**SERVICE STATIONS**

**MODINE MANUFACTURING COMPANY**

HEATING, COOLING AND AIR CONDITIONING EQUIPMENT FOR INDUSTRIAL

**NEW** **ACOUSTICALLY-TREATED, SOUND-SILENCED CASING**

A sound-silencing coating of acoustical mastic covers the entire interior surface of the casing. All noise from within is effectively deadened.

**SCIENTIFIC FAN SHROUD DESIGN**

Modine Venturi Fan Shroud, built integral with casing body, eliminates eddy currents, quieting air in-rush sound.

**VIBRATION DISSIPATORS**

Solid concentric rings of built-in fan guard absorb and dissipate vibration sounds from motor and fan.

*Only Modine Has These Quieter-Operation Features*

**NEW** **SAFETY FAN GUARD AN INTEGRAL PART OF DESIGN**

Safety Fan Guard is actually incorporated into the basic structure of the Modine unit, securely attached at four points. Instead of the menace of a unit heater fan left unshielded, Modine's staunch steel safeguard gives constant protection. Safety is standard equipment.

*Only the New Modine Has Built-In Safety Fan Guard!*

# *is the greatest of them all...*

**NEW** **PROTECTION AGAINST RUST BY BONDERIZING**

Modine is the *first* and the *only* unit heater available *protected against rust by Bonderizing.* Bonderizing not only makes Modine casing and other sheet metal parts resistant to formation and progress of rust. *It holds the finish to the metal,* making it infinitely more durable and permanently fine in appearance.

*Only the New Modine is Rust-Protected by Bonderizing.*

**NEW** **BEAUTY OF APPEARANCE REFLECTS MODERN DESIGN**

The cleaner, more flowing lines...rounded corners of the casing ...deeply recessed, V-formed louvres...all give the new Modine Unit Heater a virile, modern beauty decidedly in keeping with the latest types of store, office, or industrial plant interiors.

*Only the New Modine Gives You Style Leadership*

**NEW** **IMPROVED HEATING PERFORMANCE**

The New Modines have been carefully designed to secure increased velocities of outlet air, with greater turnover of room air, but *without* undesirable drafty conditions. The result is better heat distribution and increased fuel economy.

## AND ALL THESE ADDITIONAL FAMOUS MODINE FEATURES

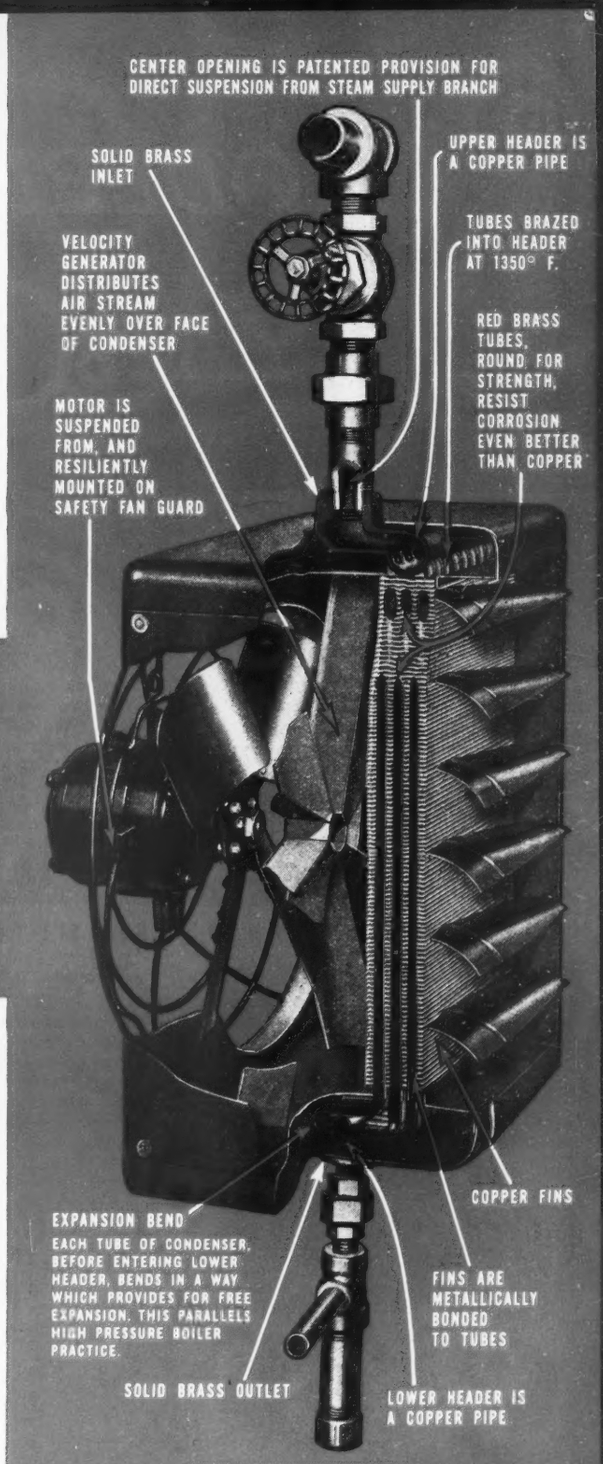
**VELOCITY GENERATORS**—an exclusive Modine development—lower operating costs by offsetting air eddy losses within the unit, thus giving greater heat "throw" without increasing power requirements —even air throw through condenser, reducing air rush and making operation quieter.

**MODINE-PATENTED EXPANSION BEND** permits condenser tubes to withstand extreme expansion and strain under high steam pressures and temperatures, easily and with complete safety, without leakage.

**ALL-COPPER CONDENSER**—All steam and condensate carrying passages of condenser are *pure copper or copper alloy—cylinder-shaped* for excess strength.

**METALLIC BONDING** preserves original heat transfer capacity between tubes and fins.

**DIRECT-FROM-SUPPLY-LINE SUSPENSION,** a *Modine-patented* feature, permits installation without hangers, saves costs of materials as well as labor.


CENTER OPENING IS PATENTED PROVISION FOR DIRECT SUSPENSION FROM STEAM SUPPLY BRANCH
SOLID BRASS INLET
UPPER HEADER IS A COPPER PIPE
TUBES BRAZED INTO HEADER AT 1350° F.
VELOCITY GENERATOR DISTRIBUTES AIR STREAM EVENLY OVER FACE OF CONDENSER
RED BRASS TUBES, ROUND FOR STRENGTH, RESIST CORROSION EVEN BETTER THAN COPPER
MOTOR IS SUSPENDED FROM, AND RESILIENTLY MOUNTED ON SAFETY FAN GUARD
COPPER FINS
EXPANSION BEND
EACH TUBE OF CONDENSER, BEFORE ENTERING LOWER HEADER, BENDS IN A WAY WHICH PROVIDES FOR FREE EXPANSION. THIS PARALLELS HIGH PRESSURE BOILER PRACTICE.
FINS ARE METALLICALLY BONDED TO TUBES
SOLID BRASS OUTLET
LOWER HEADER IS A COPPER PIPE

CROSS SECTION—STEAM TYPE

## GET THIS FREE BOOK

Whether you are modernizing or building a new store, office, factory, laboratory, warehouse or any commercial or industrial building—Modines will provide greater heating efficiency at lower cost.

Modine Manufacturing Company
1730 Racine St., Racine, Wisconsin

I am interested in something new and different in Unit Heaters—send me *free* catalog describing the New Modine Unit Heater.

*Individual*.....

*Firm Name*.....

*Street and Number*.....

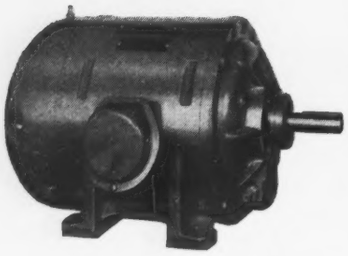
*City*.....*State*.....

**...RACINE, WISCONSIN**

**COMMERCIAL AND RESIDENTIAL APPLICATION**

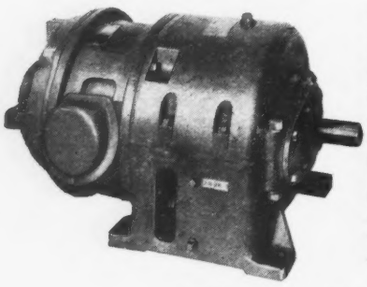
# MODERN DRIVES PAY GOOD DIVIDENDS

## MOTORS THAT CUT COSTS



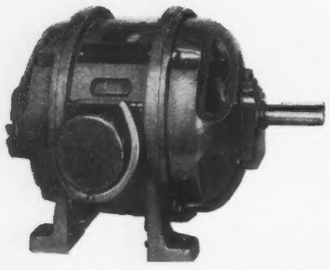
*Protected from dust, dirt and moisture* — the electrical working parts in the Westinghouse totally enclosed, fan-cooled motor are sealed from outside air, cooled by dual ventilation. Stand up in service that would ruin an ordinary motor — save maintenance cost and machine time.

**TOTALLY ENCLOSED MOTORS**



*High speed motor efficiency for low speed machines*—exact horsepower needed at the required rpm of the driven machine, all in one space-saving gearmotor. Simplifies installation, eliminates maintenance of belts, pulleys, sprockets, and chains. Delivers 96 to 98% of the motor's efficiency.

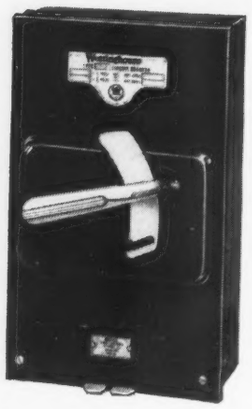
**GEARMOTORS**



*Built for a lifetime* — Westinghouse standard a-c motors deliver trouble-free performance. Rigid, one-piece frame, sealed sleeve bearings and Tuffernell insulation keep maintenance and power costs down — give you moneysaving features at no extra cost.

**GENERAL PURPOSE MOTORS**

## CONTROLS THAT SAVE TIME AND MONEY



**NOFUZE CIRCUIT BREAKERS**

*Save man hours and outage time*—with Westinghouse Nofuze Circuit Breakers. Protects motor circuits — interrupted circuit can be restored instantly without time and expense of fuse replacement.

**COMBINATION LINESTARTERS**

*Save cost on control installation* — combine all needed motor and circuit protection into one compact package by using Westinghouse Combination Linestarters. Save space, labor, conduit and wiring.

# Westinghouse

WESTINGHOUSE ELECTRIC

# $2550 return from $960 Investment

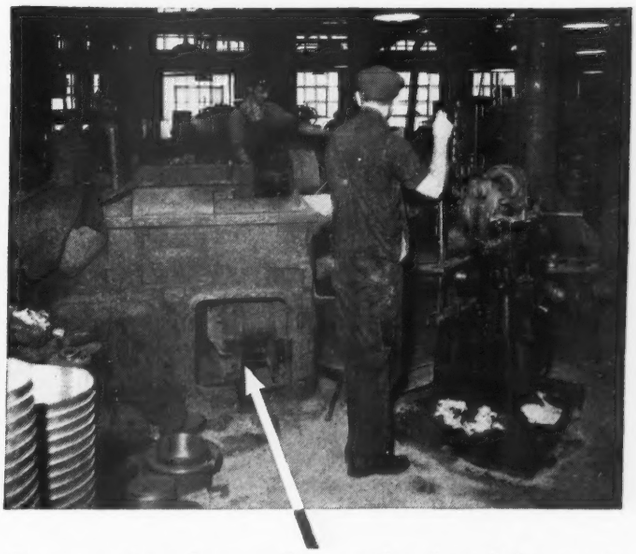
**Six Westinghouse fan-cooled motors replace ordinary types—save 36 burnouts a year—slash maintenance almost to zero—and help speed up production.**

Abrasive dust in the plant of the National Pressure Cooker Company was tough on ordinary open type motors. They were burning out about three every month. Repair costs piled up to $3000 a year — in addition to production time lost while machines were out of service.

The Westinghouse Industrial engineer suggested totally enclosed, fan-cooled motors. The first order cost $960. And since then, burnouts average less than two per year! A net saving of $2550 on a $960 investment!

If *you* want to save on maintenance and power—reduce outage time—cut manufacturing costs—make more profit—ask your local Westinghouse representative for suggestions. Or, write Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. Address Department 7-N.

Dust and dirt can't hurt this Westinghouse totally enclosed gearmotor, operating buffing machine.



Cover on drive box on this grinder doesn't keep out metallic dust — but the casing on the totally enclosed motor takes it without flinching. Maintenance and repair costs practically zero.

*There is a Westinghouse electrical wholesaler, industrial agent, or district office in all principal cities.*

J-90214

# Motors and Control

LET US HELP YOU INSTALL

# GREEN LIGHTS

## ALL DOWN THE LINE OF PRODUCTION . . .

## FOR MORE EFFICIENT OPERATION, GREATER PROFIT

Your own problems are directly affected by the kind of safety service provided with your firm's workmen's compensation insurance. Some of the differences in service, between one insurance company and another, are described on this page. An example of results, reflected in dollars, is shown in the chart opposite.

### NOT YOUR RESPONSIBILITY? BUT — ISN'T IT?

You may say you have nothing to do with insurance. But insurance *does* have something to do with you. The service American Mutual provides, helps to clear the road for production — preventing costly delays, spoiled work, loss through injury of valued workers. Employee relations are improved by your extra regard for workers' safety. And your firm gets a three-fold opportunity to increase profits. Certainly when insurance means *that*, it *is* your business.

### SAFETY SERVICE, CUSTOM-BUILT FOR YOU

Each program worked out by American Mutual safety consultants, fits that particular firm's hazards, workers, supervisors, etc. Amount of service is gauged by what the firm can use profitably, without interruptions to production or unnecessary expense.

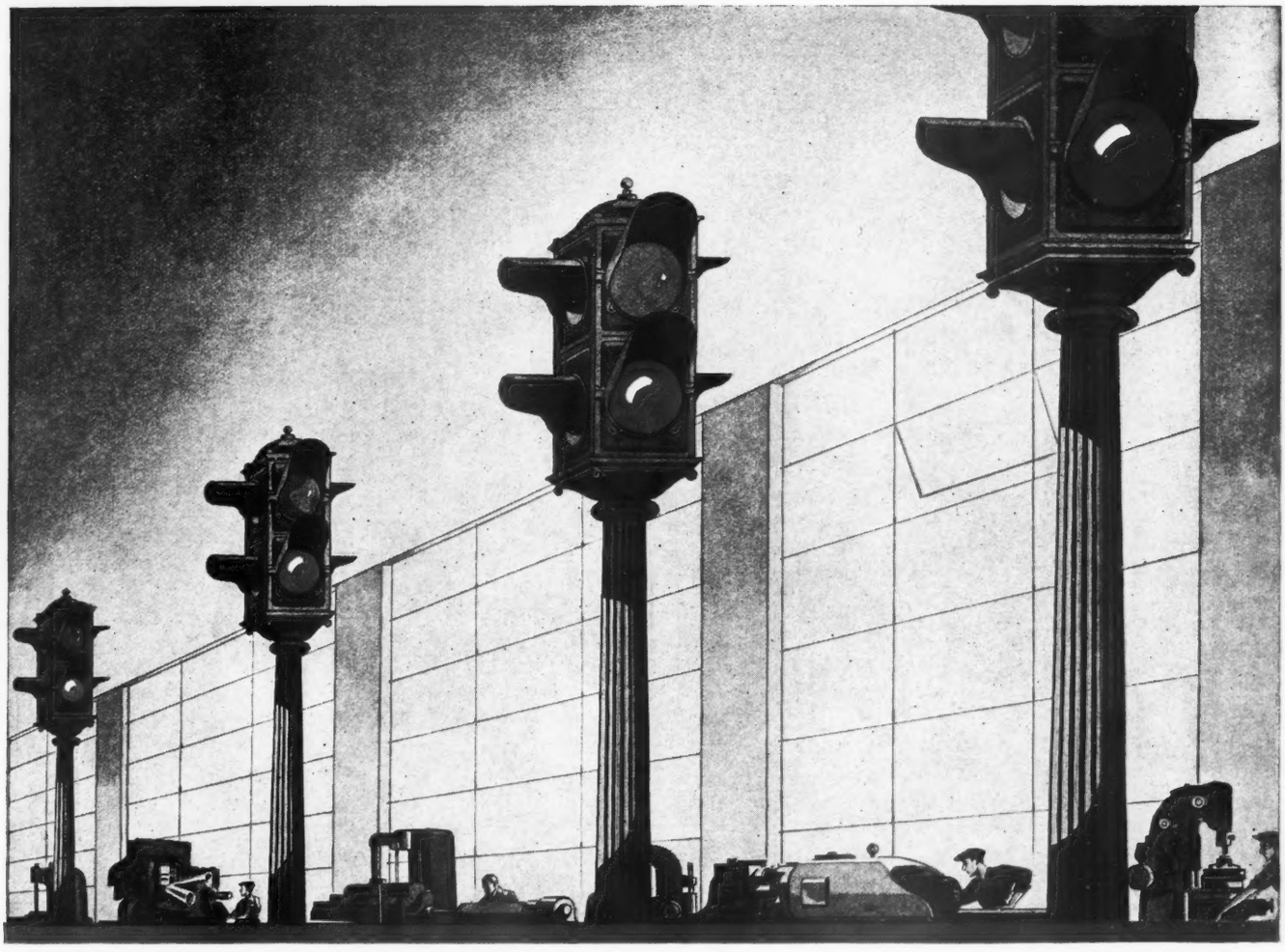
### SAFEGUARDING MEN, AS WELL AS MACHINES

Whether the program will succeed or fail rests with the employees, foremen and management who carry it out. Accordingly, the plan is designed for your *men*, as well as your *plant*.

AMERICAN MUTUAL LIABILITY

# AMERICAN MUTUAL *Works*

American Mutual has branches in 59 of the country's principal industrial centers. In addition to Workmen's Compensation, it offers opportunity for savings on Automobile, Fidelity Bond, and practically all other lines of liability insurance.



**3 PROFIT OPPORTUNITIES FROM —**

*Loss Prevention Service* which frequently lowers insurance costs and prevents time losses, lowered morale, etc., resulting from accidents.

*Specialized Medical Treatment* of injuries which helps reduce the severity of accidents and often restores valued men to their jobs.

*20% Dividends Since 1887.* For more than half a century every policyholder has been returned in dividends at least 20% of premiums. This record of consecutive dividend payments exceeds that of any other American liability insurance company.

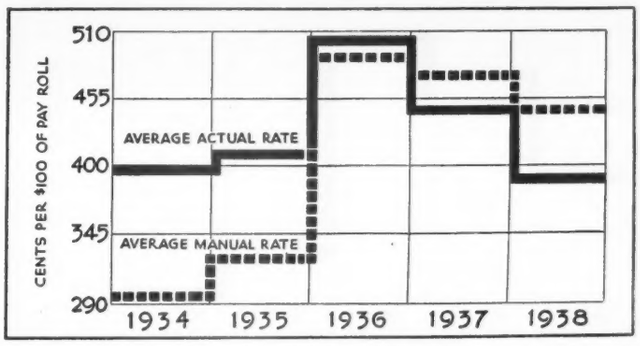
**GET THE FULL FACTS —**

FREE — Send coupon for free booklet describing our safety and medical service. No obligation.

INSURANCE COMPANY

# *to Make All Work Safe*

*Admitted Assets:* $38,330,807.41 *Liabilities:* $32,365,700.56
*Surplus to Policyholders:* $5,965,106.85 *As of Dec. 31, 1938*




**COSTS REDUCED FROM 37% ABOVE COMPETITORS, TO 12% BELOW**

The solid line in the chart shows workmen's compensation insurance rates per $100 payroll paid by our policyholder—broken line: average rates for similar New York State firms. With our help, rates were brought down from 36.6% above average in 1934 to 11.7% below average last year. Dividends brought them still further savings.

**American Mutual Liability Insurance Company**
**Dept. C-4, 142 Berkeley St., Boston, Mass.**

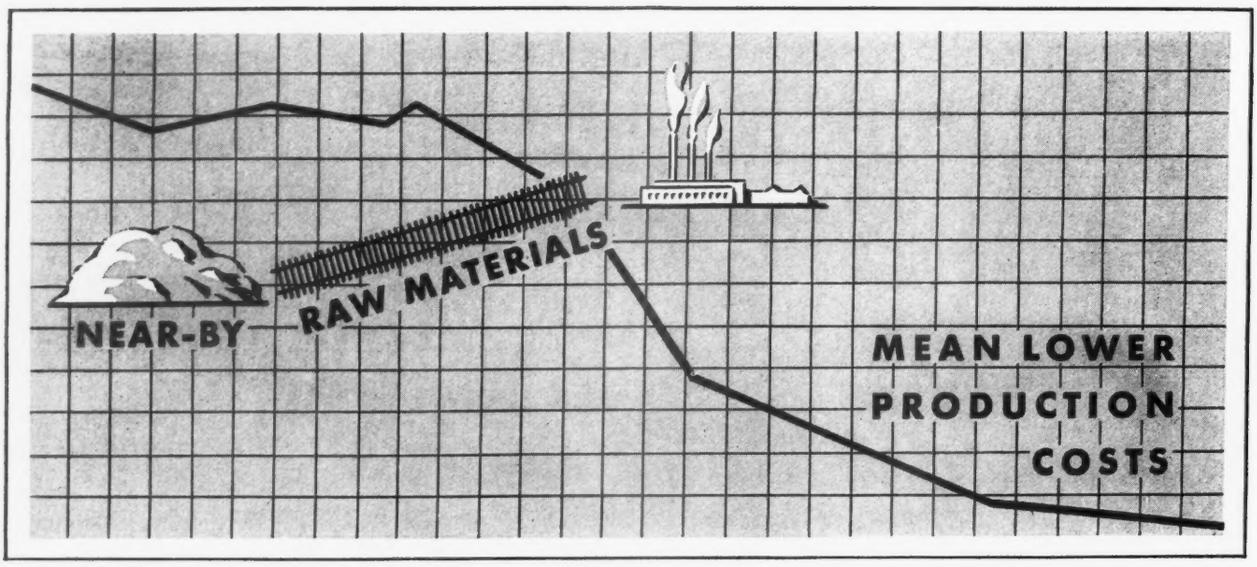
**Please send me "Methods of American Mutual in Safety and Rehabilitation Work".**

*Name*_____ *Title*_____

*Firm*_____

*Street*_____

*City*_____ *State*_____




# ...and RAW MATERIALS are PLENTIFUL and close at hand in

## *Chesapeake and Ohio Territory*

Proximity to raw materials is only one factor in the economy of strategic location—but a very important one. Chesapeake and Ohio Lines—running through the heart of Virginia, West Virginia, Kentucky, Ohio, and Indiana—penetrate and serve a region abundant in the raw materials of Industry.

In the center of this territory lies "The Coal Bin of America," the country's greatest bituminous deposits. Natural gas and oil are readily available. Here, too, are great resources in glass-sand, fire and ceramic clays, salt brine, limestone and sandstone, timber, iron ores, pure water, and agricultural products.

To the economy of near-by raw materials, add ample native-born labor, easy accessibility of major markets through magnificent transportation facilities, cheap electric power, state legislatures cooperative with Industry...and you glimpse the fundamental factors making Chesapeake and Ohio Territory a region rich in opportunity.

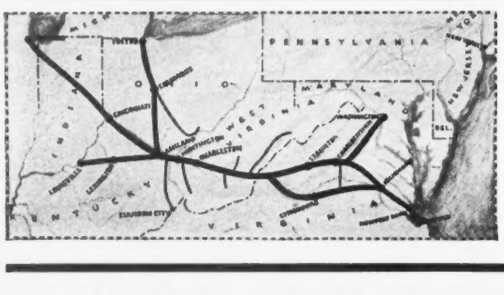
Complete and impartial factual surveys for your specific industry will be furnished on request. All inquiries will be held in strictest confidence. Write

GEORGE D. MOFFETT, *Industrial Commissioner*
CHESAPEAKE AND OHIO LINES
Huntington, West Virginia

### THESE ADVANTAGES

are but the fundamentals of many favorable conditions making Chesapeake and Ohio Territory an economic field of operation for many industries.

- RAW MATERIALS of many kinds; abundant, near at hand, economically secured.
- INTELLIGENT LABOR—native-born; largely skilled in a diversity of industries; well housed; peaceful and cooperative.
- NEAR TO MARKETS—major consuming areas within first, second or third morning delivery.
- EXCELLENT TRANSPORTATION—favorable freight rates and dependable service keep markets and manufacturers in economically close touch.
- CHEAP POWER—abundant coal, oil, natural gas and hydro-electric developments assure the region of unlimited power at most economical costs.
- COOPERATIVE LEGISLATION—Industry is king in Chesapeake and Ohio Territory, and the legislatures of the five great States in which it lies are friendly toward the needs and aims of enterprises they invite and those they already have.




# CHESAPEAKE *and Ohio* LINES

# It Cost the Company $3,000 to Put Off Re-Roofing

**WHEN THE ROOF** began to look a little doubtful, someone suggested that it should be re-roofed before winter, but someone else said: "Oh, let's take a chance. It's bonded for 20 years and it's only nine years old. If anything goes wrong, the bond will take care of us."

**THE WINTER** was pretty hard on the roof, and when spring came, there wasn't any question that the building would have to be re-roofed. So the bond was hauled out and the roofer was called in.

**SURE ENOUGH,** the bond was good, even if the roof wasn't, and the company was assured of a new roof without a cent of cost. But . . . when the old roof was taken off, it was found that serious damage had been done to the roof deck by the leaks.

**A NEW ROOF DECK** had to be built, at a cost of $3,000. The bond didn't cover that, and so it cost the company $3,000 after all. A bond is a good thing, but it's better to buy a good roof than a good bond.

**THE MORAL** of this true story is this: Bond or no bond, make sure your roofs are in good condition for the winter. Re-roof with a roof that you can forget about during the probable remaining life of the building—a Koppers Coal Tar Roof.

**OTHER KOPPERS PRODUCTS**

Koppers Waterproofing . . . Dampproofing . . . Bituminous-base Paints . . . Tarmac Road Tars for paving drives, parking areas, walks, etc. . . . Pressure-treated piling and other timber products.

**KOPPERS** *Coal Tar* **ROOFS**

BONDED IF YOU LIKE . . . BUT BETTER THAN ANY BOND

KOPPERS COMPANY · PITTSBURGH

*a* KOPPERS *product*

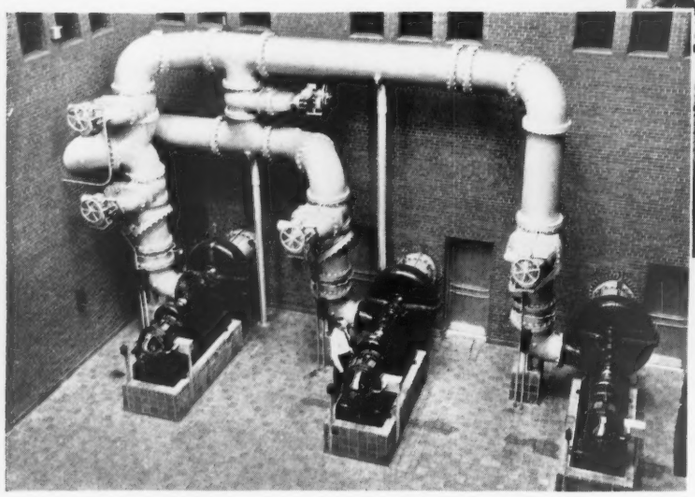
# BRIGHT IDEA

## FOR MAINTENANCE MEN

Painting brick lined steel stacks with Aluminum Paint not only brightens the industrial landscape but also saves considerable money. Rust and corrosion are successfully combatted and long periods of service are common for Aluminum Paint on stacks.

★ ★ ★

Pipe lines, too, are better protected and better looking when painted with Aluminum Paint. That holds true whether they are outdoors or indoors, like the piping shown below in a Cleveland sewage disposal plant.



**GET THIS MANUAL, FREE**

Gives you complete technical data about the types of Aluminum Paint to use for different services. For advice on any special problems, write Paint Service Bureau, ALUMINUM COMPANY OF AMERICA,* 2126 Gulf Building, Pittsburgh, Pennsylvania.

ALCOA ALUMINUM

ALBRON Paste for

*We make no Aluminum Paint; only Alcoa Albron Paste and Powder, the pure Aluminum pigments you get in leading brands of Aluminum Paint.*

# ALUMINUM PAINT

TYPE FS1, FS2, FS3
NO AUXILIARY DEVICES

TYPE FSL1, FSL2, FSL3 WITH STANDARD LATCH

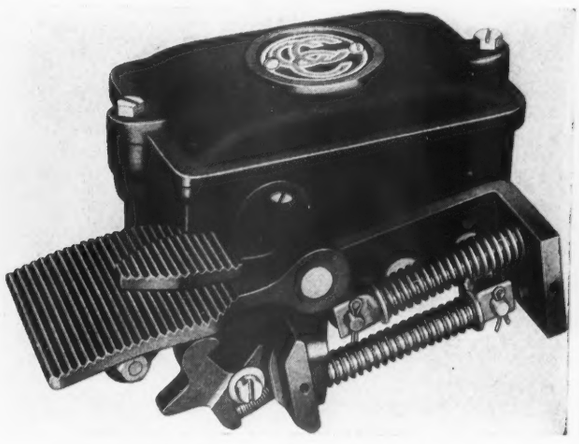
## "3C" BULLETIN 101 FOOT OPERATED HEAVY DUTY MASTER SWITCHES 5 TYPES AS ILLUSTRATED • 5 DIFFERENT CONTACT ARRANGEMENTS

Available with or without latching devices and with or without auxiliary external return springs, these "3C" Foot Switches are sturdily built to provide exceptional service in heavy duty operation.

Contact fingers interchangeable with other "3C" switches; double break silver to silver contacts; oil impregnated main shaft bearings, and at all pivotal points; large electrical and mechanical clearances; and many other features are described in a folder which is yours for the asking.

TYPE FSL1S, FSL2S, FSL3S
WITH STANDARD LATCH AND AUXILIARY SPRING

TYPE FS1S, FS2S, FS3S
WITH AUXILIARY SPRING

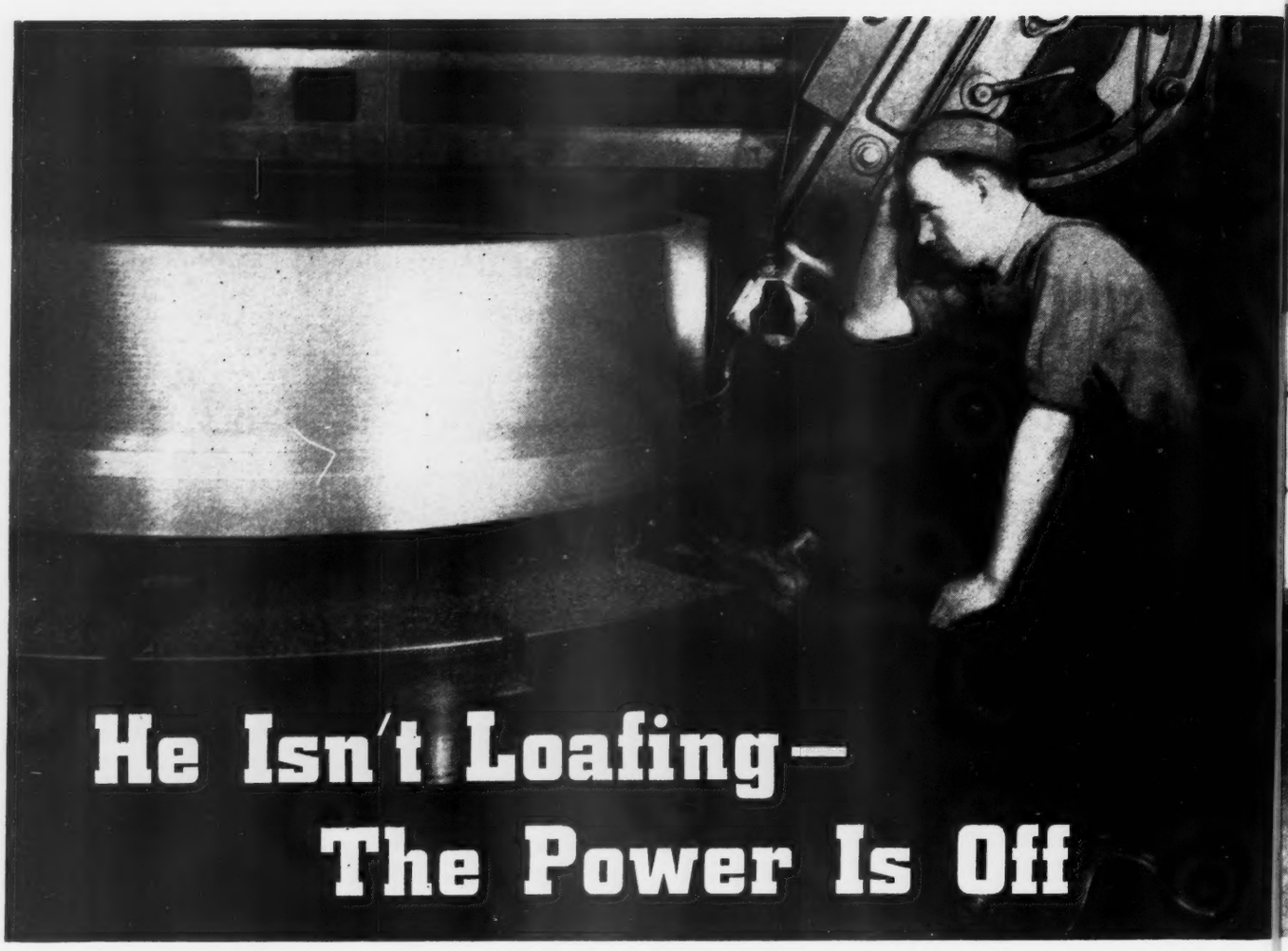


TYPE FRL1S, FRL2S, FRL3S
WITH SPECIAL LATCH AND AUXILIARY SPRING

OFFICES IN PRINCIPAL CITIES

**THE CLARK CONTROLLER CO.**

1146 EAST 152ND ST. CLEVELAND, OHIO



# He Isn't Loafing—
# The Power Is Off

* Interrupting Capacity

## There Wasn't Enough I C*

THIS man wants to work. Yet everything is held up for repairs—all because a protective device, faithful for years, tried to interrupt a short circuit too severe for it to handle. It didn't have sufficient "I C" (Interrupting Capacity) to interrupt the severest short-circuit currents possible on that line. This can happen in any plant where the protective devices do not have the necessary "I C"

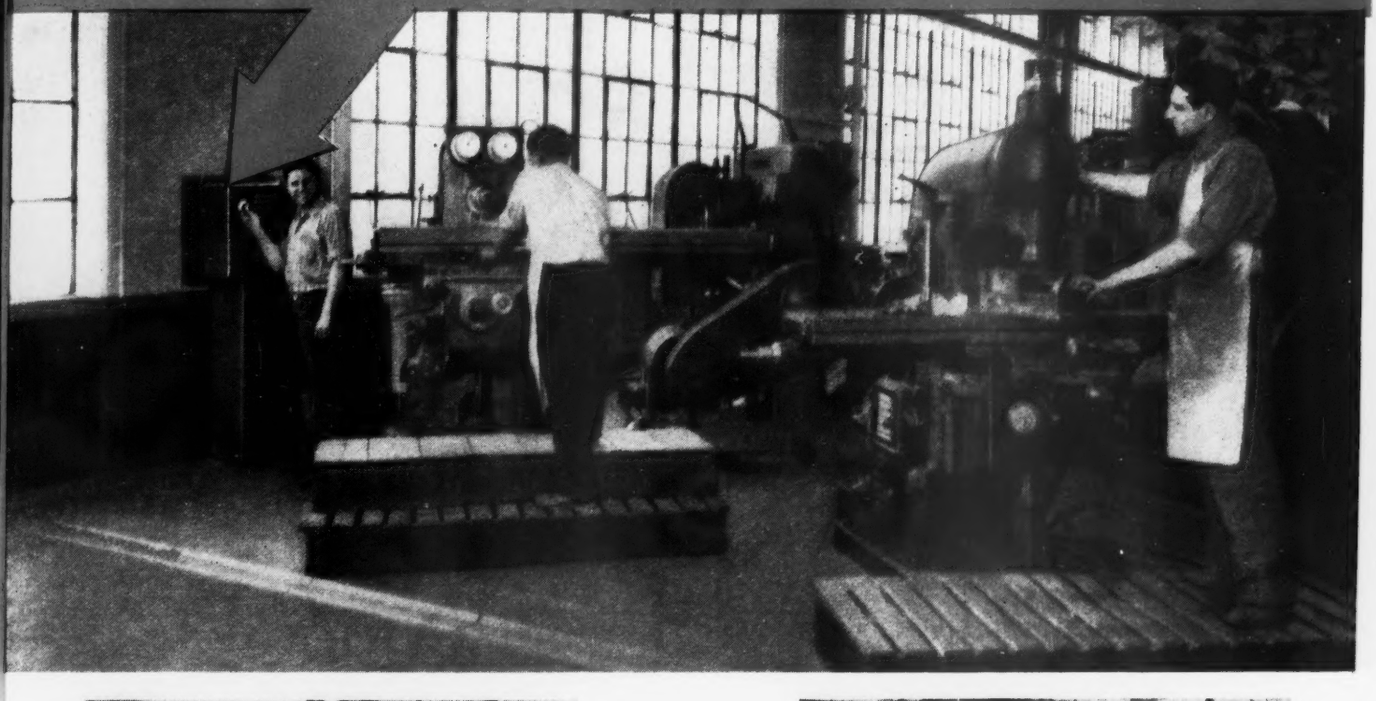
It depends largely on the capacity of the transformers, and it can not be determined by the normal load on the circuit. As plant loads have grown, transformer capacities have been materially increased. Therefore, short circuits present an ever-increasing hazard. They seriously endanger personnel and property wherever the power supply has outgrown the interrupting capacity ("I C") of the protective devices.

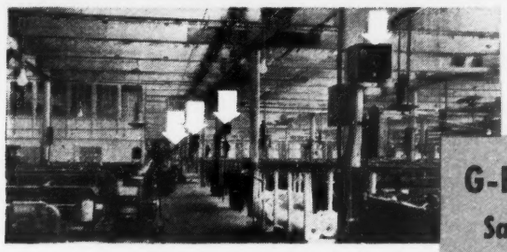
Are you sure of your "I C"? With G-E air circuit breakers of known interrupting capacity, you can be sure.

**G E N E R A L**

# There's No Waiting Around

## Where G-E Air Circuit Breakers Are Used To Restore Service





Many industrials are demanding air breakers for branch-feeder protection

**G-E AIR BREAKERS**
**Safeguard Employees; Keep Labor and Expensive Machines Productive**

G-E air breakers with adjustable trips permit heavy welding currents, but open on dangerous overcurrents

For safety's sake, specify safety-enclosed, factory-assembled air-breaker switchboards for low voltage main feeders

Out with obsolete devices — in with G-E air circuit breakers

GE

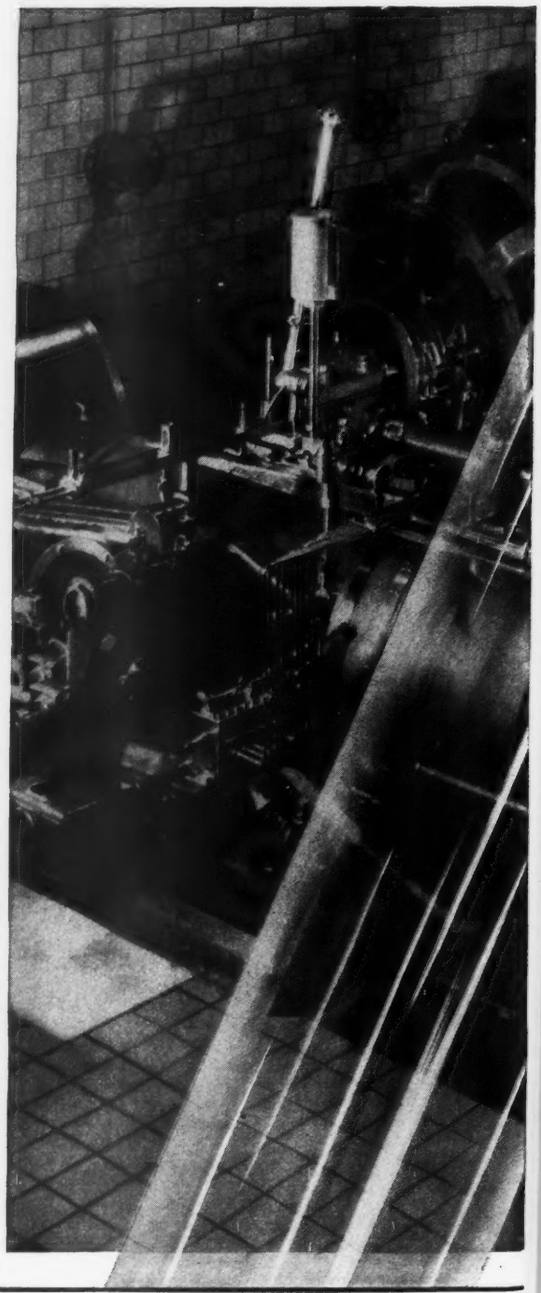
890-88



# ELECTRIC

# GARGOYLE STEAM

# Seal Up Pr



**Here are 3 important facts to remember about Gargoyle Steam Cylinder Oils:**

1. **These oils are quality leaders... known throughout the world.**
2. **They provide an effective oil seal for pistons, valves, and stuffing boxes... help stop costly steam leakage.**
3. **They reduce wear... help assure low cost for power—low costs for engine repairs and maintenance.**

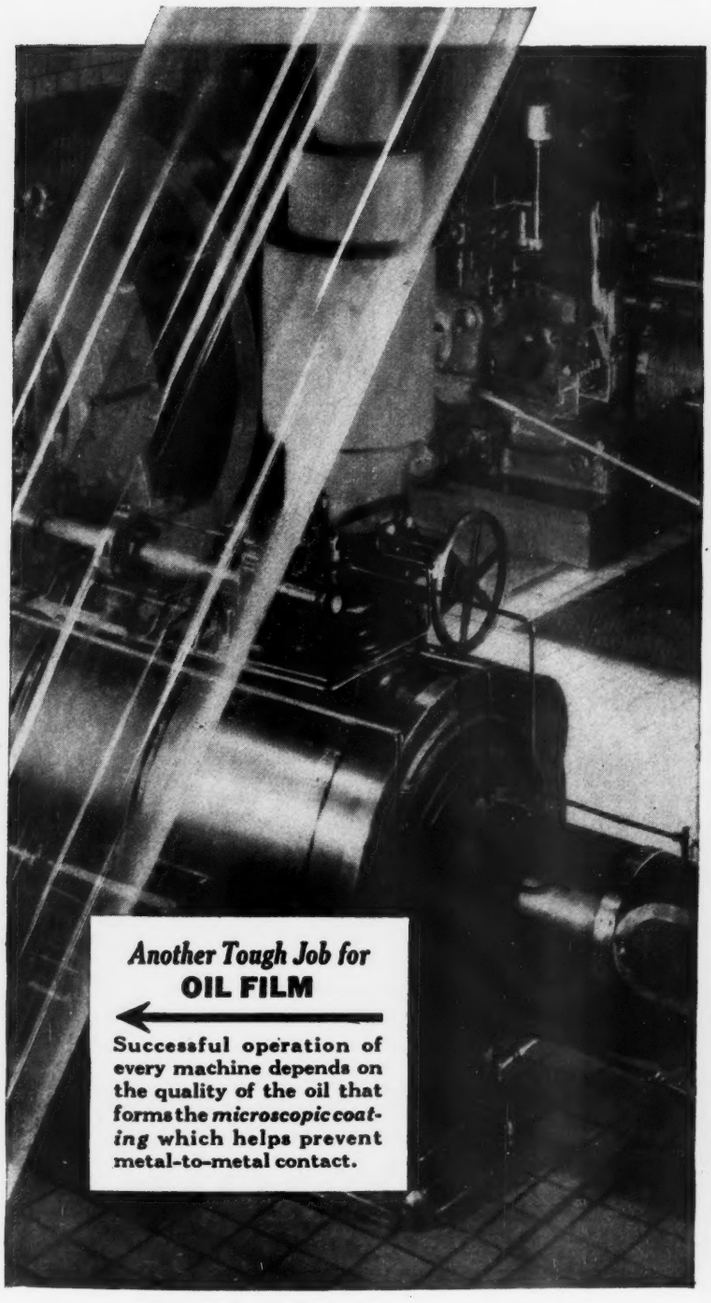
THE SOCONY-VACUUM man offers you a complete line of lubricants, plus these *exclusives:*

The right lubricant for every machine . . . and new lubricants ahead of new needs . . . developed by world-famous research laboratories through close cooperation with machine builders.

73 years' experience—thousands of case histories—to guide in prescribing the right use of these lubricants to gain Lubrication Profits for you.

World-wide distribution and guaranteed uniformity—the same quality available everywhere.

# CYLINDER OILS HELP
# ofit Leaks


Another Tough Job for
OIL FILM
Successful operation of every machine depends on the quality of the oil that forms the microscopic coating which helps prevent metal-to-metal contact.

SOCONY-VACUUM

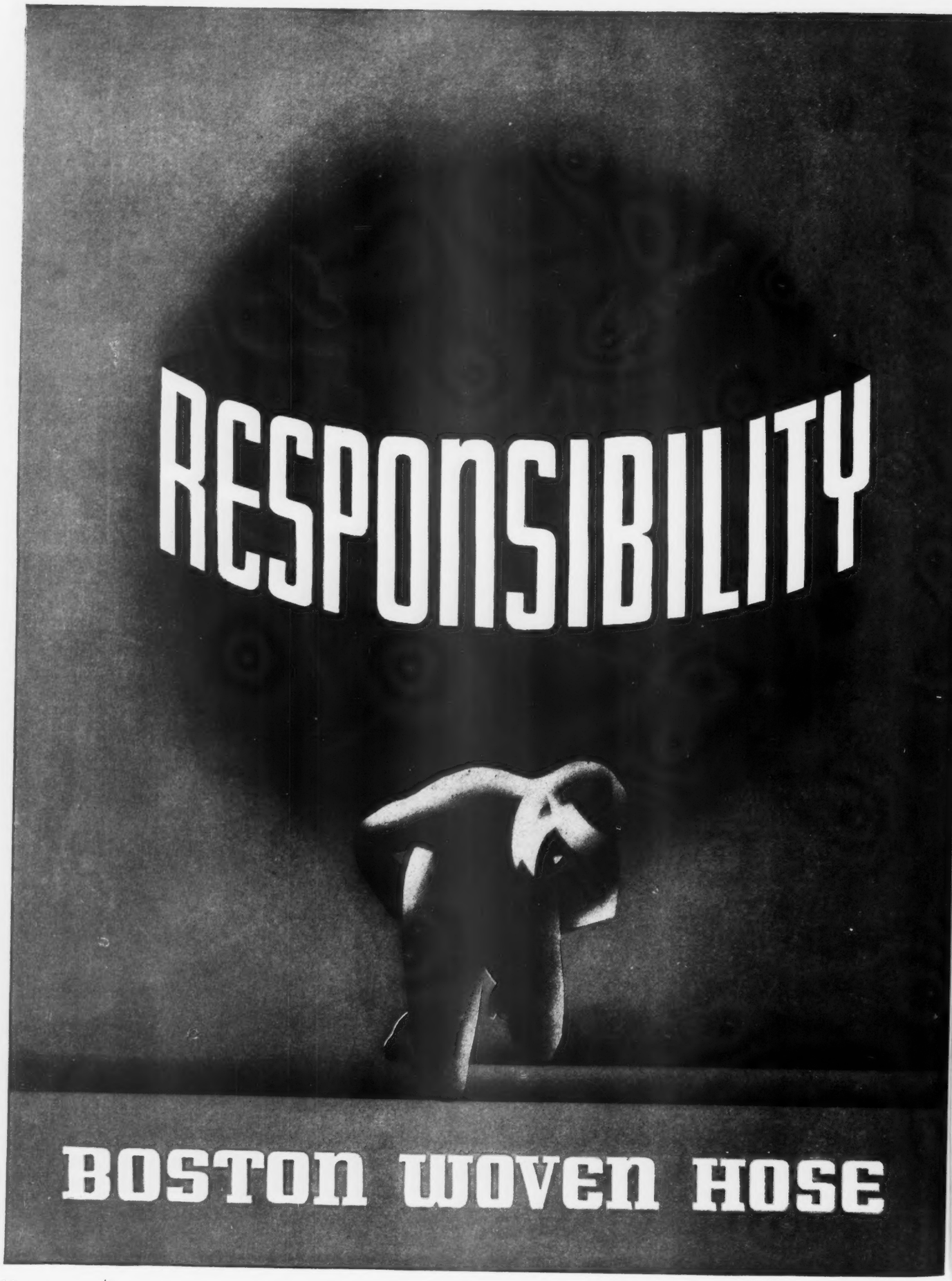
Industrial Service and Lubricants Help to Lower Costs by

*Correct Lubrication*

GARGOYLE Lubricants

SOCONY-VACUUM OIL CO., INC.

Standard Oil of New York Division · White Star Division
Lubrite Division · Chicago Division · White Eagle Division
Wadhams Division · Magnolia Petroleum Company
General Petroleum Corporation of California

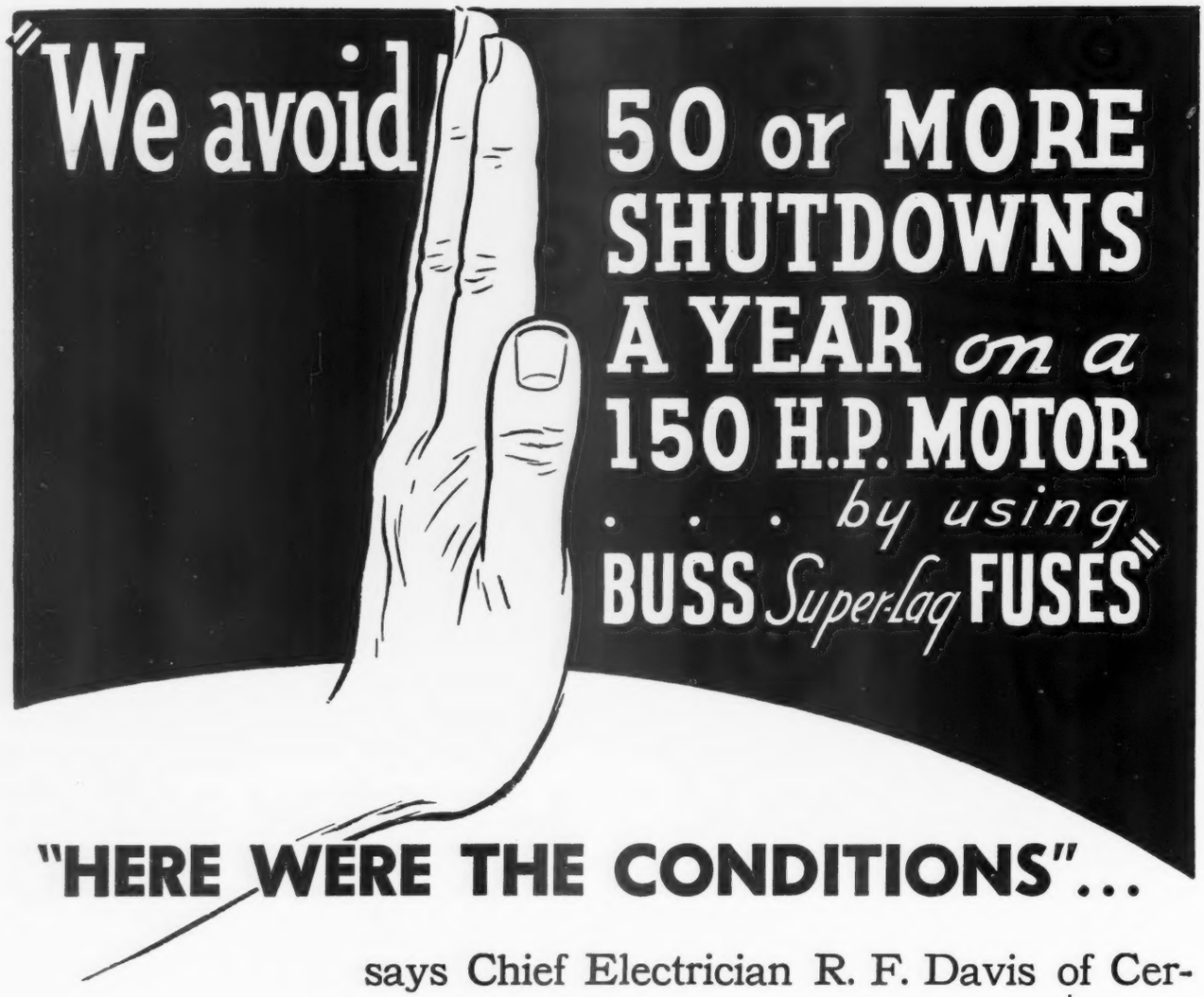

RESPONSIBILITY
BOSTON WOVEN HOSE

# IT PAYS TO BUY BY NAME!

**A product that fails to deliver what the manufacturer promises, and what the buyer has a right to expect, is a loss to both — the buyer and the seller . . . Years ago buyers tried to judge the value of rubber hose and belting by tearing the plies apart to "test the friction" . . . Today, the keen buyer chooses his source of supply intelligently and places full responsibility on the manufacturer. And that is exactly where it belongs . . . Buying Mechanical Rubber Goods on the basis of a hand test is sheer gambling. The product may have many weaknesses which remain hidden until after installation . . . B.W.H. products are "built with honor" with a knowledge of sixty-one years progressive experience behind each and every brand.**

WORKS:
CAMBRIDGE, MASS., U.S.A.
POSTAL ADDRESS:
BOX 1071, BOSTON, MASS., U.S.A.

# & RUBBER COMPANY




## "HERE WERE THE CONDITIONS"...

says Chief Electrician R. F. Davis of Certainteed Products Corp., Acme, Texas. "Fuses used in a 400 ampere switch that protected a 150 hp. 3 phase 400 volt 60 cycle motor rated at 201 amperes were blowing prematurely about once a week.

"A salesman suggested we switch to BUSS Super-Lag fuses as they have one-piece links with copper terminals. We did—and we haven't had a single blow and no heating of fuses or clips in more than a year.

"Not only that but we formerly had to clean the fuse terminals every 30 days and now we don't clean them more than once a year."

# *If you have "Alibi" Shutdowns in your plant...* BUSS FUSES MAY SOLVE YOUR PROBLEM

"Alibi" shutdowns is a name that can be aptly applied to shutdowns blamed on plant or operating conditions INSTEAD OF ON PLANT EQUIPMENT.

For example, when fuses blow needlessly—because of the development of poor contact within the fuse itself—IT'S JUST AN ALIBI TO BLAME conditions—when FUSES THAT PROTECT BUT DO NOT OPEN NEEDLESSLY are available.

Why should any operating executive accept as a necessary evil useless shutdowns that cost so much in time and money when—as far as fuses are concerned—they can be practically wiped out?

*Investigate the shutdowns in your plant*

Maybe right in your own plant you are suffering from useless shutdowns.

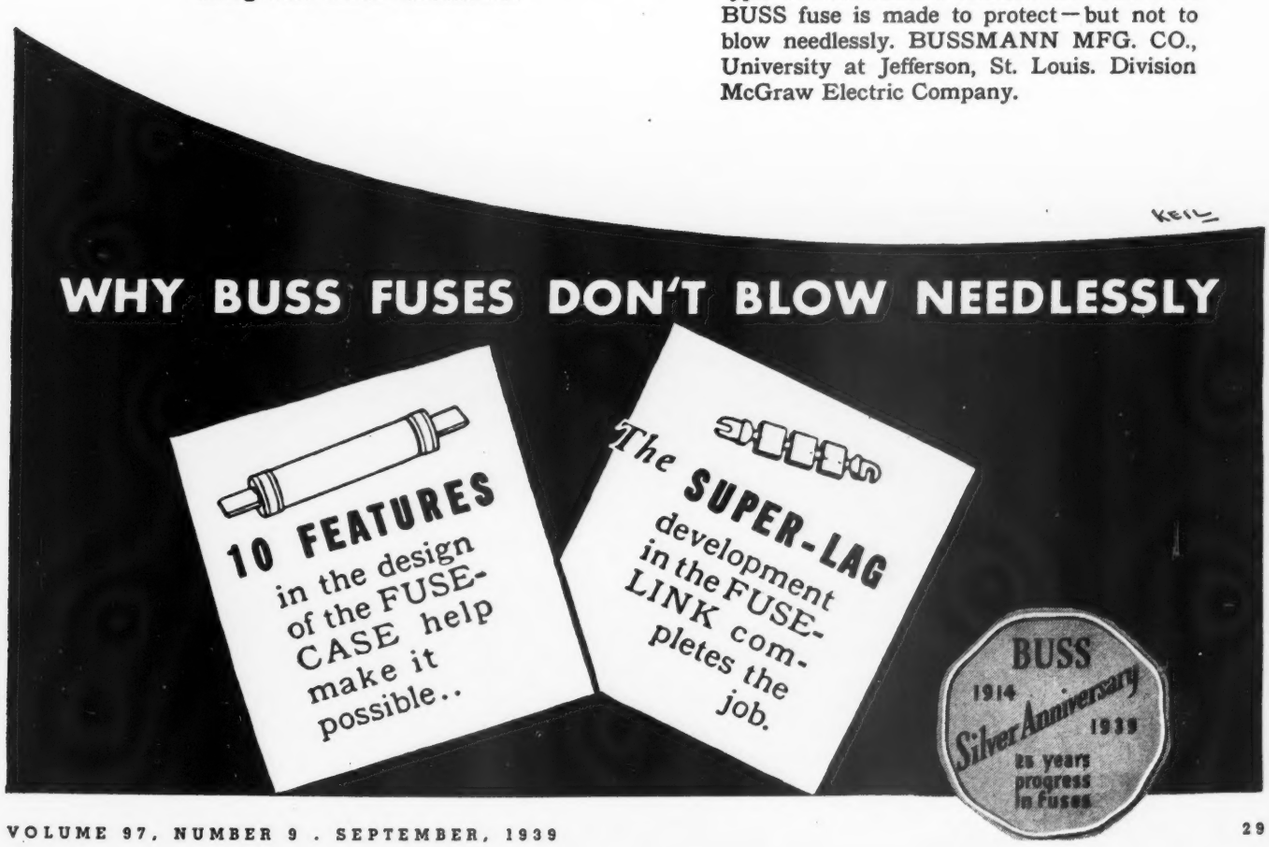
If you are and somebody blames them on fuses—that's the time to do some careful checking.

The chances are that BUSS Super-Lag fuses will solve your problem. BUSS Fuse-Cases are so made that they prevent the development of poor contact within the fuse—and BUSS Fuse-Links have super-long time-lag that permits them to hold on without blowing when harmless overloads occur.

Thus BUSS fuses help eliminate the two greatest causes of protective devices opening needlessly.

*Get this book on*
*"How to Select Renewable Fuses"*

Write for a free copy. You will find it unusually interesting as it compares various types of fuse construction and shows how the BUSS fuse is made to protect—but not to blow needlessly. BUSSMANN MFG. CO., University at Jefferson, St. Louis. Division McGraw Electric Company.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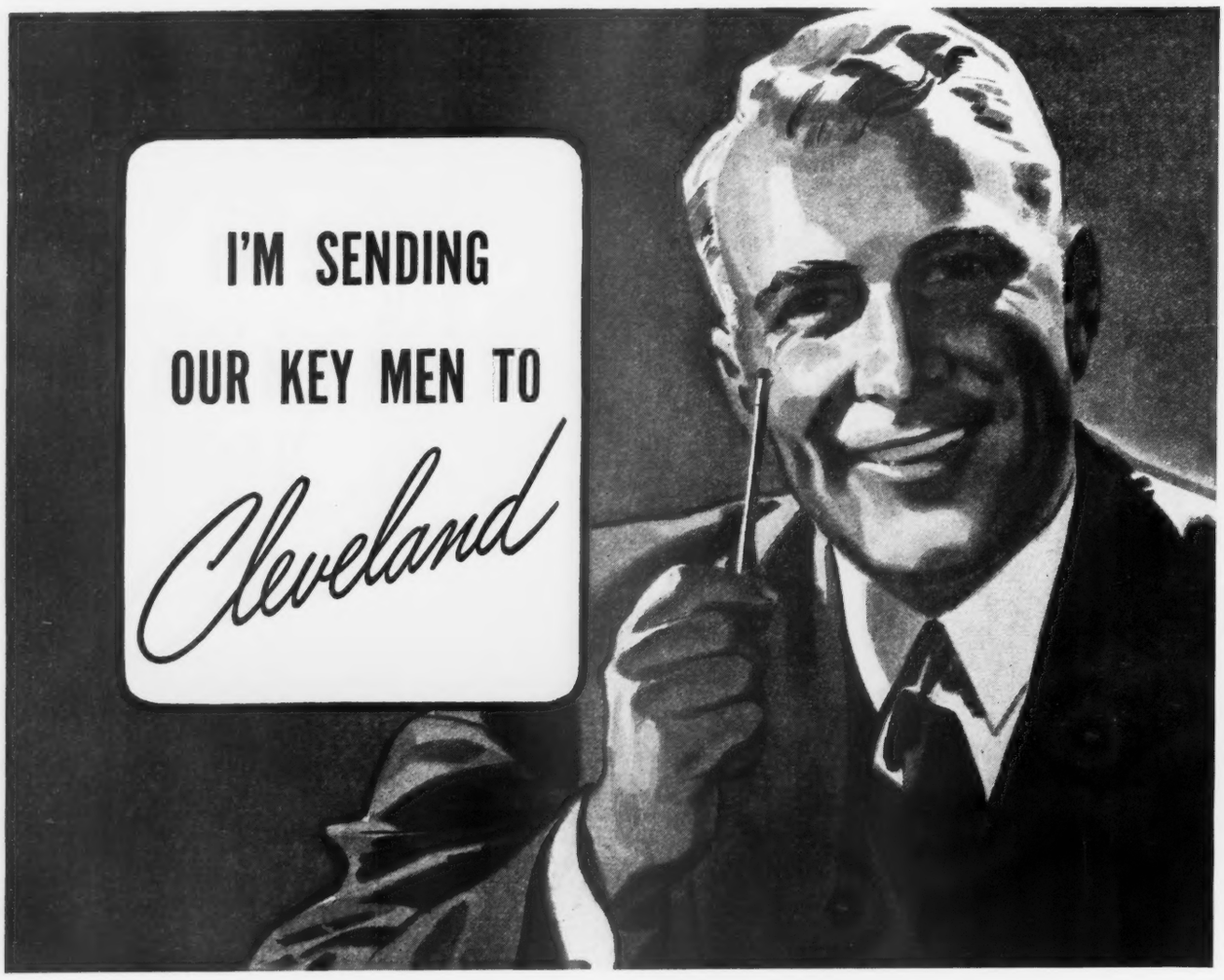


"When the last Machine Tool Show was held in 1935, I let one of our men go over. I thought he could look around and bring back all the information we would be interested in having. The first day of the show he called me up long distance. Told me I must come over the next day and bring three department heads with me.

"Well, I went over that night, and the next day I was on the long distance phone, but instead of three men I had six come. It was one of the best things we ever did. We had the combined judgment of our principal key men in regard to the new developments and what we should do to profit by them.

"There will be twice as many of us this time. With the show lasting for ten days, we can have our key men stay long enough to do the thing right. And this year I'm going to get a couple of our directors over to the show if I have to 'shanghai' them to do it."

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# Learn about Rubber Rolls

## FROM THIS STEEL MILL VETERAN OF 275,000 TONS' SERVICE!

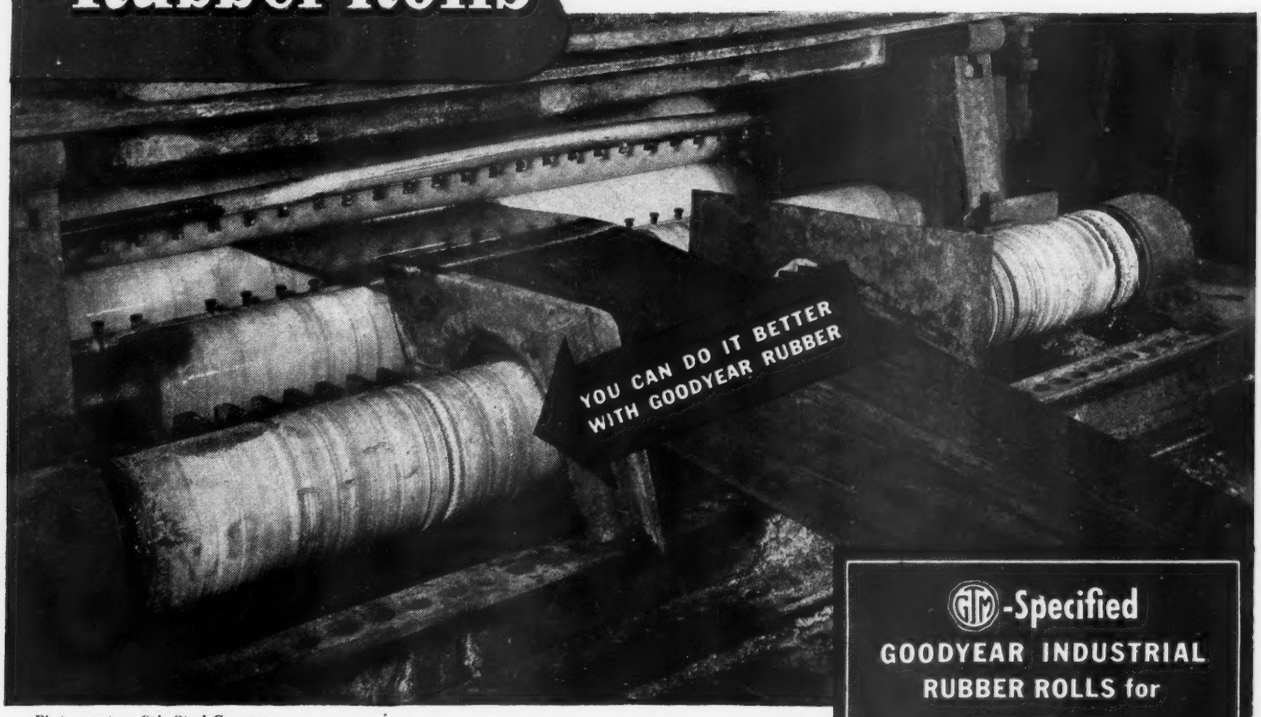


*Photo courtesy Otis Steel Company*

IF you use rubber-covered rolls in any type of industrial process you will be interested in the extraordinary record of the Goodyear rubber roll pictured in the foreground of the above photograph.

More than 275,000 tons of sheet steel—a tonnage equal to the weight of eight great battleships—have ridden on this carrier roll in the continuous strip pickling plant of the Otis Steel Company plant at Cleveland, Ohio. Any steel man will tell you that this is truly remarkable performance under the abrasion and cutting incident to this service.

The secret of such standout performance is the exact scientific compounding and curing of Goodyear industrial rubber rolls to meet the demands of the service for which they are intended. Goodyear chemists have developed a variety of special compounds for manufacturing rolls especially resistant to acids, alkalis, heat, lacquers, paint, oil and other chemical solutions—as well as impression rolls for die-cutting cookies or for use with die-stamping machines.

We invite your inquiries on built-to-specification rubber rolls for any type of service. The G. T. M.—Goodyear Technical Man—will be glad to make a careful analysis and recommendation that will insure longer, trouble-free service. Just write Goodyear, Akron, Ohio, or Los Angeles, California—or phone the nearest Goodyear Mechanical Rubber Goods Distributor.

*Centennial of Charles Goodyear's discovery of vulcanization*

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**STEEL MILL USE**

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| Laminating | Plastic Spreading |
| Wringer | Plastic Washing |
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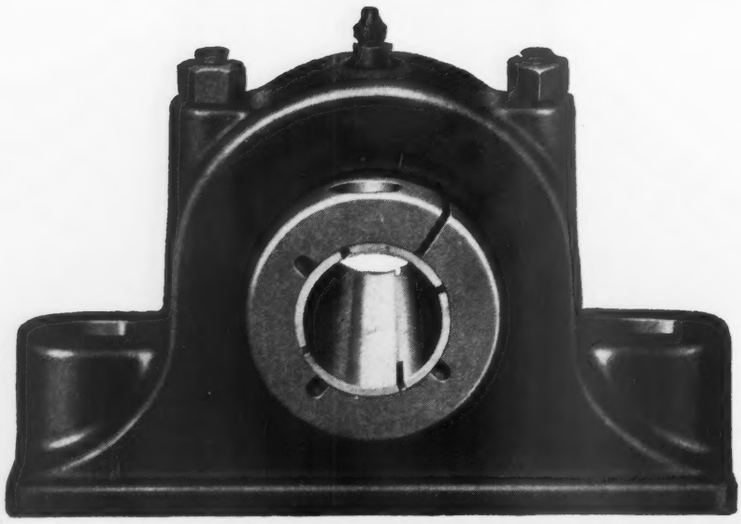

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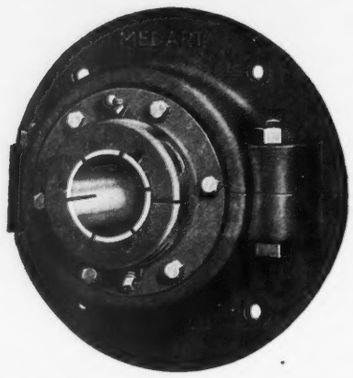

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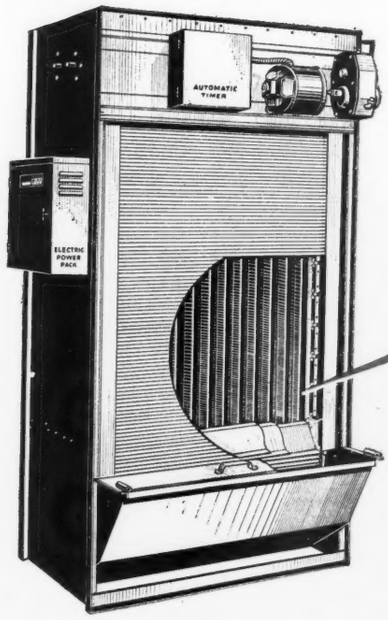


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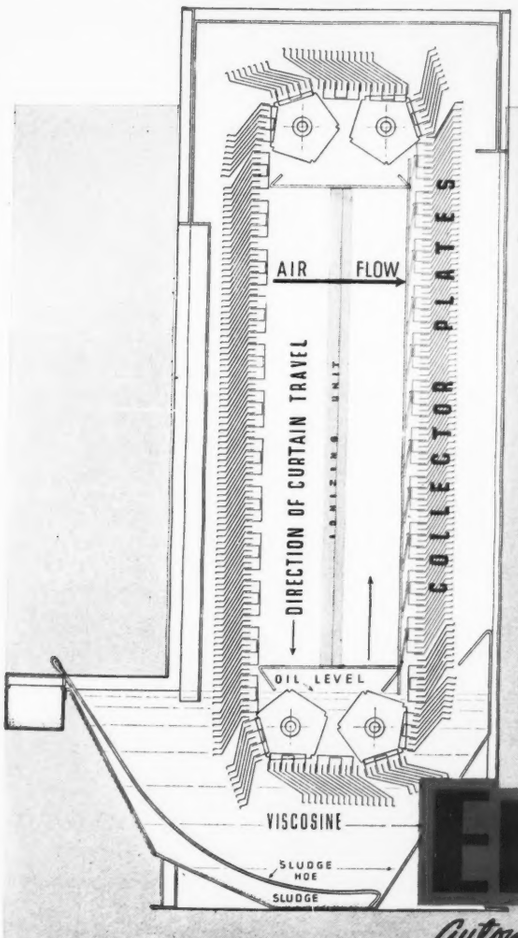


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(Old Ideas that Power Distribution necessarily involved groups of Circuits definitely limited to *fixed* locations and *fixed* types and capacities.)

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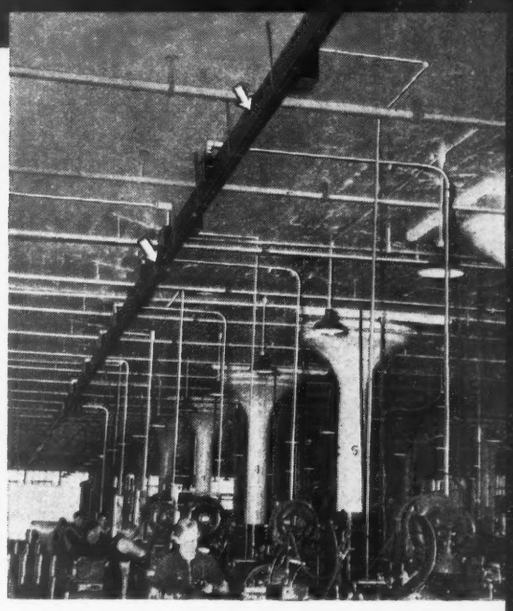

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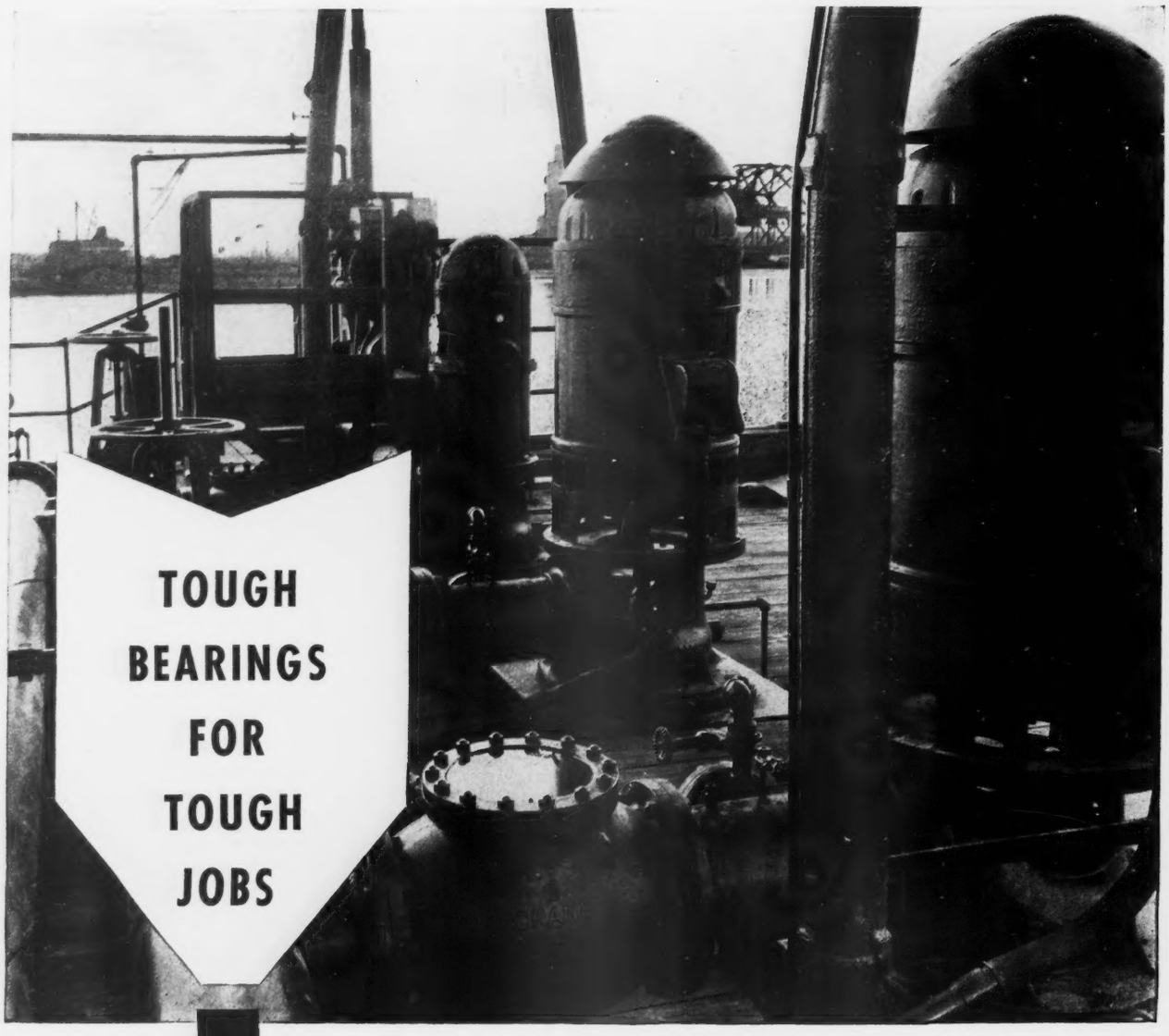
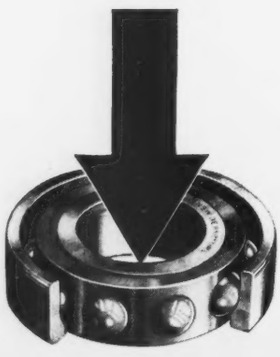



## - - - mean contracts finished on time



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2785

# NEW DEPARTURE

THE *FORGED STEEL* BEARING

# IF

# EUROPE GOES TO WAR

●

## How Will It Affect American Industry?

Editors' Note: *This report, designed by* FACTORY *to provide a quick glance at the changing European situation in the light of its meaning to U. S. industry, represents the views of leading economists and Washington sources, combined with information obtained from affiliated McGraw-Hill magazines. The report was completed August 30, and is subject to any reinterpretation occasioned by later developments*

**PREMISE** ASSUMING that a new European war will again find England, France, and assorted allies pitted against Germany and assorted allies (with Italy a little question mark and Russia a big one) U. S. industry may look for an approximate reproduction of the 1914 scene with certain very important modifications.

**BACKGROUND** In 1914 the machinery of international credit was paralyzed almost instantly by the war's onset. Between July 28 and 30, the major bourses of the world shut down. On July 30 the London and New York stock exchanges closed their doors. The latter reopened under very severe restrictions on November 28, and did not operate normally until the following April 1. World commerce was slowed both by shipping and credit tie-ups. In the United States, the last five months of 1914 saw further irregularities in the depression existing at that time with a decline, except in certain lines, of commodity prices (cotton especially), stock prices, industrial production, and employment.

Then, as credit tangles were adjusted and England opened the sea lanes, orders from the Allies poured in. Any American plant equipped or convertible for munitions work was promptly swamped. At the turn of the year, America embarked on a boom, beginning with feverish activity in steel, munitions, copper, and lead, and spreading to automobiles, boots, blankets, food and machinery. By mid-1915, America faced rising prices and a labor shortage. The gradual loss of most of our commerce with the Central Powers (12 per cent of our foreign trade before the war) was soon offset. The stock market rebounded from earlier heavy liquidation of foreign holdings.

War orders were recklessly placed and recklessly accepted. Harbor, dock, lighterage, and shipping facilities were jammed. Thanks to the shortage of bottoms and the hazards of passage, shipping

rates skyrocketed. Vessels were known to return their cost in a single voyage. Meanwhile, demands for American goods rose in neutral markets formerly supplied by the belligerents. As the embargo ended on ferro-manganese and crude rubber, our Latin-American trade hit new highs.

Backlog of the 1915 boom, however, was the tremendous stimulus in British, French, and Russian trade, although this has been estimated at no more than $2,000,000,000. Great Britain went into the war with a favorable exchange rate here. It was some time before this was reversed by her heavy imports and her liquidation of American holdings. Finally it became necessary for the Allies to seek extended credit here, first through private and finally through government loans. Until this was accomplished, another slowdown was threatened.

**THE PATTERN**

The pattern is one of shock, temporary inactivity, readjustment, then greatly expanded trade, then shortening of the belligerents' credit, and finally, new stimulation by means of private and government loans (the last amounting to a cash bet on the winner with involvement almost certain to ensue). *Now, as then, everything depends on England's mastery of the seas.* This granted, the outlines of the pattern should hold, although the variations within them may be great.

**FACTORS OF VARIATION**

Here are some of the most important differences between today's situation and 1914's. First, England is prepared, industrially and financially, for war. It is estimated that she already has capital resources here as high as $4,000,000,000 to $5,000,000,000 (about $1,000,000,000 in gold, the rest in securities) and probably another $2,000,000,000 in other world markets. She now has her own munitions industry, whereas in 1914 she had only a few scattered government plants of which Woolwich Arsenal, employing 10,000, was the only big producer. And she has already made large imports of needed war goods, such as American machine tools and South American food supplies.

Nor are others unprepared. World finance, and U. S. finance with it, have tried to build storm cellars for the refuge of international credit exchanges when the winds of war begin to blow. The U. S. Treasury has labored long to prepare an "economic parachute" to soften the descent of the securities market so that it might not even be necessary to close the stock exchanges. Plus this, Washington is said to have ready a series of proclamations for issuance at the moment of war's outbreak. The nature of these is not known, but there are plenty of alphabetical channels through which shock-easing measures might be introduced.

While Britain and allies will arrive with a large market basket, Germany and allies are not expected to be big buyers here *after* war begins. The dictator nations have been recent big purchasers of U. S. raw materials, war supplies, and some munitions. But this time the British blockade is likely to clamp down sooner, for Britain is no longer one jump behind the Germans in submarine warfare. American public opinion, moreover, would probably be sympathetic to such a blockade. Nor does Germany have the credit resources here that she did in 1914. At that time the Central Powers had money in America—in fact, a large share of our market slump was credited to liquidation of German and Austrian holdings. Thus our commerce with Germany did not immediately cease after war's declaration. This time there is no chance that it can continue.

On the other hand, Latin-American and Eastern markets will probably make a large and immediate demand on American producers for all sorts of goods. South America's extensive commercial expansion since the last war is not to be overlooked as a factor. First, the Latin-American nations will probably do a brisk and profitable business with the European belligerents. Second, there are many products, such as electrical wiring equipment to give one example, for which South America has depended largely on European producers. This market should be thrown open to U. S. goods.

Here are two of the most outstanding changes which make for variation from the 1914 pattern. This time our Neutrality Act says "No" to every possibility that American plants may be hastily thrown into the manufacture of guns and ammunition as so many were before. The sale to any nation at war of rifles, guns, tanks, aircraft and plane parts, ammunition and explosives, gas, and every other item in the arsenal would be forbidden. But this is perhaps not the formidable bar to general trade that it seems to be—for four reasons. First, actual munitions have been estimated to constitute only about 10 per cent of needed war supplies, the rest of which are unrestricted. Second, Britain can make her own munitions and will not need ours so direly. Third, the transfer of munitions production facilities (especially aircraft) to Canada is a recent trend of much significance—since a great deal of American capital is behind this evidently effective move to offset neutrality restrictions. Fourth, when Brit-

ain establishes her blockade, exports to her foes will virtually cease. Furthermore, the War and Navy Departments and the new War Resources Board might have something to say if American producers become tied up in production for foreign customers. Even now, if a U. S. manufacturer falls behind in the production of government orders in order to fill foreign demands, he must get permission to continue from the priorities division of the War Resources Board.

Second big change is the Johnson Act which says "No" to loans to foreign governments (except Finland) either by our government or by private firms. At present some American firms do extend credits to foreign governments. Although the legality of this policy is questionable under the Act, no test has as yet been made. But in war time the Neutrality Act would reinforce the Johnson Act's provisions on this point.

* * *

*Note*: Two moves are in the making which might change the picture with respect to our present munitions and loan restrictions. President Roosevelt would be almost sure to call a special session of Congress immediately after war's declaration to ask again for the Neutrality Act amendment, denied him at the last session, which would empower him to name aggressors and designate the nations (England and allies, presumably) to which arms could be sold. The Congressional opposition to this move has power, however. If the President wins his point on neutrality, the next step might be an attempt, as credits tighten, to break the restrictions of the Johnson Act.

## ESTIMATE OF THE EFFECT OF 1939 VARIATIONS ON THE 1914 PATTERN

Some of the above factors enhance, others decrease the likelihood of an immediate U. S. industrial speed-up. *Chief thing to remember is that 1914 experience has already produced policies which should greatly reduce the interval of temporary inactivity between the war's outbreak and the big war-time demands for U. S. goods.* But while the boom may arrive sooner, its run may be shorter due to the lessened resources of the warring nations and the restrictions of the Johnson Act and the Neutrality Law.

### WHAT'S WANTED?

Belligerents, their own industrial facilities and man-power concentrated on the war effort, are usually in need of basic raw materials, machinery, food and clothing. In the Latin-American markets, the demand seems likely to rise for almost every sort of American goods including luxury lines. Here are some of the items in which European producers have had a majority of the South American market and which, in wartime, they will no longer be able to supply: Diesel engines, electrolytic copper, iron, steel bars, sheets, and structural steel, industrial power machinery and drives, agricultural machinery, electrical wiring, light bulbs, railroad equipment, and clothing.

### OUR RAILROAD BOTTLENECK

In 1914 an acute shortage of shipping tonnage and harbor facilities made foreign trade hectic. This time the "bottleneck" is due to occur on the carriers. Even allowing for the increase in truck traffic, it is significant that in the ten years ending 1938, retirements of railroad freight cars have exceeded replacements by an average of over 60,000 cars a year. Half of the cars in service are over 20 years old. Facilities would be overtaxed by any consistent loadings of 850,000 cars a week—and there were three weeks in 1937 when they hit 838,000. Locomotive ownership has also declined. The roads would be 1,100 units short here if they were called upon to handle 1937 peak loadings consistently.

### INFLATION? WAGES? EASY MONEY?

War is always inflationary. But the initial reaction is apt to be otherwise. While the pick-up may begin sooner this time, the prospect of immediate serious inflation is not considered strong. For one thing, the cessation of imports from the belligerents should tend to shake things down, as it did before. For another, no great shortage of commodities is immediately visible. As a third factor, we went into 1914 with few unemployed, whereas today there is a tremendous slack to be taken up in the labor market before wages would advance materially (though certain demands may be made) except in skilled lines.

A prominent New York economist doubts that we shall return to the "easy money" conditions of early 1939, but predicts that money prices will not be materially tightened by war in Europe. He believes that, as long as the United States keeps out of the war, taxes will not be substantially boosted, but that, if we go into it, some of the confiscatory measures that have already appeared in Congress (such as the May, Lee, and Connally bills) would stand a good chance of passage.

### "WAR BABIES"

War abroad seems almost certain to jerk our petroleum industry out of the doldrums. Prices and demand in the world market should be almost unprecedented. (Gasoline in

Italy is currently retailing at 95 cents a gallon) . . . A big demand for rubber products is assured but the supply of crude rubber is considered slightly uncertain . . . Copper seems certain to get something of a boost . . . Lumber prices are already up and producers are rationing supplies to American buyers in the presence of a pronounced foreign demand . . . An interesting sidelight is the prediction of a New York realtor that building materials will boom instantly on war's declaration owing to the desire of buyers to "hedge" on inflation by acquiring property and building homes . . . Rails and railroad equipment should be in line for stimulation by *any* pronounced upturn in industrial activity . . .

**SKILLED LABOR**

FACTORY's report on trends in the metal trades industries of Cincinnati (current issue, page 64) points to the conclusion that any sort of boom would uncover a shortage of skilled labor. It is not generally realized that even now employers in the precision industries of certain Eastern cities are advertising regularly in the midwestern papers for skilled help. Apprentice training programs in most cities appear still to be in the "paper stage." In event of war, industry's return to the stop-gap "vestibule schools" of World War days would be a strong possibility.

**CASH OR CREDIT?**

FACTORY asked this question of an outstanding analyst: "In the event of war, should American manufacturers insist on cash in dealing with new foreign customers?" The answer: "Yes." This reply is significant of the need for extreme caution by American manufacturers in their approach to the whole question of war business.

U. S. manufacturers are cautioned to deal warily with suave strangers, usually wearing spats and an air of mystery, who approach them with "blue sky" schemes for getting foreign business. These gentlemen generally seek a monthly retainer or a flat commission on all orders from some foreign nation or nations *whether they get the business or it just drifts in.* The "blue sky" boys victimized both foreign buyers and American manufacturers in World War days. They have been active since then whenever events focused attention on some nation as, for example, the recognition of Russia and more recently the end of the Spanish War.

Business Papers International Corporation urges every American company so approached to check carefully before signing agreements. Export practice has been so thoroughly standardized since the War that every competent export man is known in the field and his standing can easily be verified through trade associations, banks, and other informed contacts.

This does not mean that some legitimate foreign business won't come knocking at the doors of American plants. The warning is: *Don't be swept off your feet by any proposal.* If a large foreign business is contemplated, it is recommended that a good export manager be added to the payroll. Another way of handling the business is through the established export houses. These operate in a variety of ways. They may act as brokers, they may pay cash for goods, or they may charge a retainer. Export houses are not to be confused with freight forwarding firms, which handle only the technical job of arranging for rail freight, lighterage, shipping, and so forth. If a company has its own export manager, he will deal with the freight forwarders direct. If export agents are retained, they will handle the contact with the forwarder.

**SUMMARY**

If only because of the experience factor, it seems improbable that the outbreak of war in Europe would be followed here by an inactive period of such long duration as that which occurred in 1914. But predictions of an immediate boom should not be given complete and literal acceptance: First, because the plans for bolstering stock prices are viewed with so much skepticism in some quarters; second, because so much war buying has already been accomplished; third, because there is every presumption that one big buying factor, Germany and her allies, would be shut out of our markets from the start. Strongest offsetting factor is the prospect of trade with the South American nations. They will have the money with which to buy because they will have a market for their primary products.

Nor should it be forgotten that this time Great Britain is capable of producing most of her own munitions, which tends to transfer the emphasis to raw materials and credits. This is too often overlooked in the heated discussions of neutrality legislation, which governs, after all, only a small portion of total exports. In the last analysis, a British blockade may more effectively regulate our war-time commerce than the laws we propose, revoke, or amend. *Except* those relating to credit. Thus Neutrality Act amendment may have its chief importance merely as a prelude to discussion of Johnson Act revision. But America's eyes are open, this time, to the fact that war loans lead to war itself, costly in lives and dollars.

FACTORY
MANAGEMENT and MAINTENANCE
L. C. MORROW, Editor

# Just What Is "Civil Liberty"?

IN THE NAME OF "CIVIL LIBERTY" industry has again been smeared by a government committee. This time the tar brush is the report to the Senate by Senators LaFollette and Thomas, a sub-committee of the Senate Civil Liberties Committee, condemning the National Association of Manufacturers for many of its activities.

Most of the accusations are not news because they were publicized during the two years of hearings. The public formed its judgment long ago, so nothing would be gained by rehashing the details here. For the most part the actions of individual corporations were in question; the association cannot be held responsible for everything each individual member-unit does.

*The alarming thing about the Committee report is its apparent conviction that the NAM is not entitled to civil liberty.*

Says the report: "In effect the National Association of Manufacturers is a vehicle for spending corporate funds to influence the opinion of the public in its selection of candidates for office. It may be questioned whether such use of the resources of corporate enterprise does not contravene the well-established public policy forbidding corporations to make contributions in connection with political elections."

Corporate funds, as a rule, are the only kind of funds a business association has. If the association is to do anything at all for its membership, and funds are required in the doing, it is corporate money that must be spent. Certainly it is not in the public interest if corporate funds are contributed to campaign treasuries. But their use in public relations cannot be questioned. And that is the point at issue here. As a matter of fact, the funds for its public relations activities were collected by the NAM specifically for the purpose in a frank, open manner.

As to action taken to influence the opinion of the public in its selection of candidates for office, that is the procedure of democracy. All sides tell their stories—the public takes its choice. For an association to state its own case to try to influence public opinion, is civil liberty. What kind of funds did John Lewis make available in the last presidential campaign? What funds are being used by the federal government in efforts to influence public opinion in favor of its methods and procedures?

Again from the report: " . . . the National Association of Manufacturers has flooded the country with biased propaganda directed against organizations of American workingmen and against social legislation adopted by Congress."

Biased from whose point of view? And must every action of Congress be accepted without protest or comment? If so, and if a specific group is not permitted to try to influence the selection of the members of Congress, what then? If there is a difference of opinion between organized labor and employers, must the public hear only the labor side of the case? Certainly organized labor has never had its propaganda wings clipped or its lobby spurs blunted.

Fortunately, the report is so extreme that it is likely to nullify itself. Its net effect will be all the weaker because it was compiled in the name of civil liberty.

L. C. Morrow

# The Industrial Town

**What will it be like? Architecturally it may resemble the General Motors city of the future (see cover photograph). We don't know as to that. But we *do* know that in it human relations must come first, as it does in "good" industrial towns today. Here, for all industry, is a tale of towns whose progress in industrial harmony indicates the way toward new gains for private enterprise**


CHARLES B. COATES

*Assistant Editor*


WHY DOES ONE industrial city sail smoothly through the years with little or no labor strife while another, exactly like it to the outward eye, erupts periodically into the headlines with strikes, riots, bitterness, and violence?

What is the secret of City *A*, so peaceful that its orderly progress goes almost unnoticed? What is wrong with City *B*, so turbulent that its industries have already lost millions through strikes which, in turn, have discouraged expansion and frightened away new enterprises? What happened in City *C*, where strife suddenly gave way to harmony?

There has been a lot of news about industrial warfare. Industrial peace is news, too—important news. If every city met the standards of City *A*, there would be no national problem. Yet America's industrial machine is now rated, by some experts, as low as 60 per cent efficient because of friction among its human parts.

The manufacturing industries are the mainspring of the national economy. They account for only a quarter of the national income, yet in 1938 a drop of 27 per cent in manufacturing activity was responsible for 50 per cent of the decline in our total income. Colby M. Chester, Chairman of General Foods Corporation, pointed out recently that a 25 per cent increase, or $3,750,000,000, in gross manufacturing income "would do more to stimulate re-employment and economic recovery than twice three and three-quarters billions expended by government pump priming."

### On the Road to Recovery

"Each of us would surely concede that a 25 per cent increase in efficiency is entirely possible," he told the American Management Association in a compelling plea for better personnel administration. "Each of us, as individuals, might admit that he is capable of greater efficiency. Then why not for business as a whole?"

One city's industrial efficiency is not necessarily greater than another's. But every city of *A* caliber is a definite signpost on the road to billions of dollars' worth of recovery because it has removed the first obstacle to efficiency.

The industrial town of tomorrow! What will it be like? Never mind the sweeping highways, the cubistic business buildings, the ultra-modern homes, and the streamlined factories of the futurama. Those things will take care of themselves—*if the human relations are right.*

We have no ideal cities—yet. But certain cities *can* claim outstanding records of industrial harmony. FACTORY's editor recently instructed me to find some representative cities of *A* grade, visit them, study them objectively. It was hoped that certain principles might be discovered that would prove of interest, and perhaps of value, to other cities.

Lacking a more exact yardstick, I impaneled an informal jury of leaders in management and industrial relations. Government statistical agencies lent a hand. Nine cities were tentatively selected by consensus of the "jury." Milwaukee was named because it *appeared* to have the best strike record for cities of 500,000 or over. Closer inspection compelled me, regretfully, to reclassify it as a borderline case. Cincinnati was chosen because of its outstanding experiments in good government and its handling of unemployment. It proved interesting on this score. In industrial relations, on the other hand, it is only so-so.

Dayton and Middletown, Ohio, and Rochester, N. Y., were cited for their traditional freedom from labor trouble, or at least from its worst effects. Toledo was chosen as the leading example of a "come-back town." South Bend, likewise—but to a lesser extent because it didn't have so far to come. Evansville attracted notice because of its public relations program (described in FACTORY, December, 1938). Kingsport, Tenn., was singled out as a "planned" industrial city.

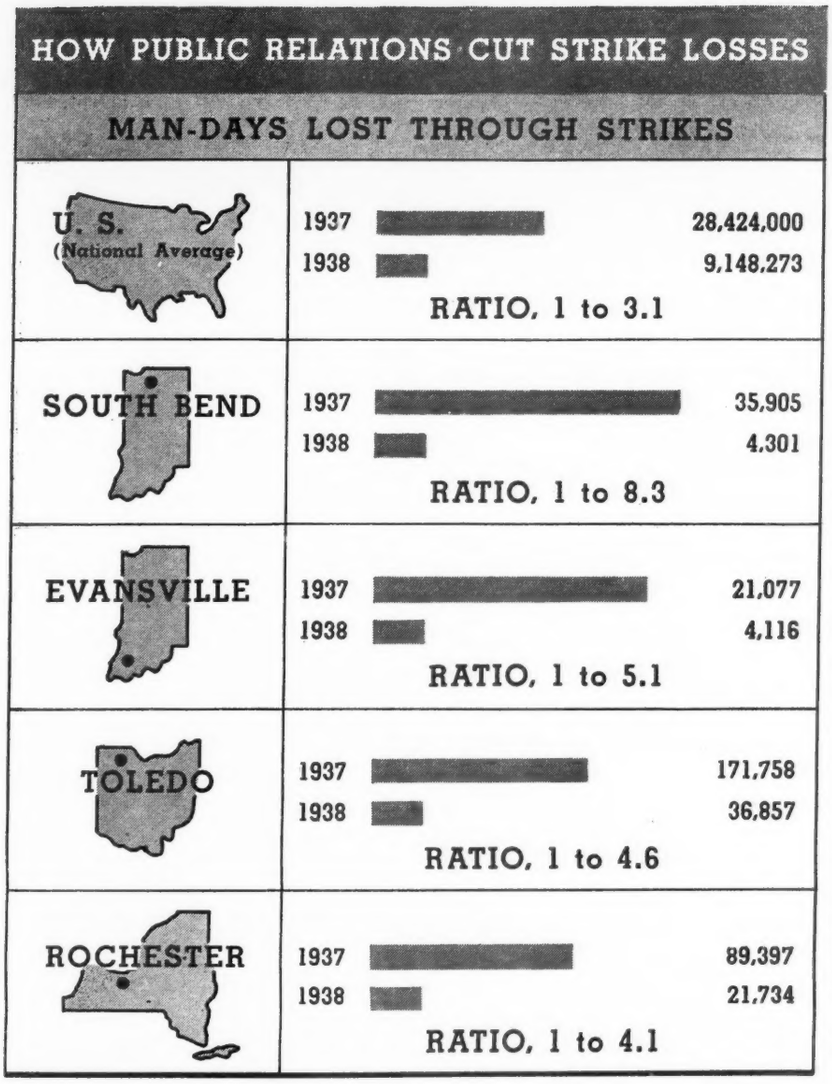
Nearly all the people I talked to in these cities—top industrial management men, city officials, newspapermen, chamber of commerce executives, and labor leaders—were deeply interested, eager to help. Assured that interviews were off the record, they spoke very frankly. There were some "big names" among them, and their collective opinions represented scores of years of experience and observation. I tried also to talk casually to as many *kinds* of people as possible—storekeepers, lawyers, factory workers, social service workers, policemen, taxi drivers. In this way, one gets a sort of "candid camera" picture of a town.

Now here's a sweeping statement for you: *The best towns I saw were those where industrial management has accomplished the most in good public relations.*

Public relations begins in the plant and spreads out through the community, affecting finally the national attitude toward private enterprise. Every management is inescapably engaged in public relations—good, bad, or indifferent. The influence of each company is thrown into the balance, locally and nationally for weal or woe, with a weight exactly equal to its size.

Public relations begins with *top* management, pervades the entire industrial

# of Tomorrow




**It may be an accident, but the strike records of four cities outstanding in public relations have shown greater improvement than the national average in reducing strike losses between 1937 and 1938. South Bend, Evansville, and Toledo have recently acted vigorously to spruce up on community industrial relations. Rochester relies on a long-standing tradition of harmony. Dayton, Middletown, Ohio, and Kingsport, Tenn., have had so little labor trouble that they do not even appear in the Labor Department's annual strike statistics, and so are not shown on this chart. Of the other cities considered in this survey, Milwaukee (which was crossed off *Factory's* list of Grade *A* cities) suffered almost as many strikes in 1938 as in 1937. Cincinnati, included in the study for other reasons, also failed to equal the national average**

organization, from majority stockholder to factory sweeper, and reaches out into every phase of civic life. *Good public relations is founded on good labor relations in the plant and good citizenship in the community.*

In an Ohio city I saw a grim, grey-stone mansion surrounded by a high, forbidding iron fence.

"The people who built that house owned a mill here," I was told. "They sweated their employees, did nothing for the town, lived entirely to themselves. They were symbols of capitalism and they were disliked. When they went broke nobody was sorry."

To be liked and understood, modern management must tear down its iron fences and live in the town. When a town's dominant industrial employers are working *actively* to make it a better place to live, then that town is on the upgrade and so are its industries.

The cities included in this study were chosen solely because they appeared to enjoy good records for industrial harmony or to have done good work in overcoming bad situations. That was all I knew about them.

I found that industrial peace is only a symptom of something bigger called "the civic spirit." The best of these cities are distinguished for their handling of community problems—government, unemployment, relief, health, housing, safety, education, culture, recreation. I found that most of them are above the national average in home ownership and in the *per capita* possession of automobiles, radios, telephones, and electric meters. Most of them are below average in tax rates, death rates, bonded indebtedness, and slum areas. The best of them are "high wage" towns where the number of individual income tax returns is above average but the discrepancy between big and little incomes, mansions and shacks, is less pronounced.

### In the "Good" Towns

I found that good government, usually taking the city-manager form, is a fixed characteristic of "good" towns. When a city's government is costly, debt-ridden, and corrupt, it lays a heavy burden on tax-paying industries, consumes the funds that should be available for constructive public purposes, and weakens the effectiveness of social and civic agencies.

I found strong community chests and chambers of commerce that blasted utterly the cynic's conception of the C. of C. as a vain, florid, ballyhoo device. The old-fashioned civic secretary who looked like a lame-duck congressman and talked like a circus barker is rapidly giving way to men who are quiet, competent, brilliantly well-informed on basic economic problems, and astonishingly frank.

Back of good civic agencies, I found strong personalities—usually industrial management personalities, whose influence radiates in a thousand directions through the whole fabric of the city's social structure.

*Capsule illustration:* I met a young business man in a small city that has a rather mixed background of good and bad public relations and is still in the in-between stage. I told him so, men-

tioned the slums, the sharp differences in industrial wage scales, and the disgracefully high death rate.

"I know it," he said, "and we're doing something about it. I never gave such things a thought until they got me into the community chest and rubbed my nose in them. I'm glad they did and I'm proud of the time and money I spend in the work."

From this he has gone on to thinking about good management in his own business. He wants to do something for the eight or nine men who helped him to success. He'd like to find some way to help them buy or build homes (like so many sincere management men all over the country who wish wistfully that they could go into employee housing without getting into the real estate business or being accused of paternalism). He's working out a profit-sharing plan and hopes eventually to transfer the business to the men.

This man gave me a sales talk on good management. *Yet he appeared perfectly unconscious of the connection between his own awakening and the presence in his city of some important new management personalities who have given the lethargic old town's civic spirit a powerful hypodermic.*

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**"The people who built that house owned a mill here," I was told. "They sweated their employees, did nothing for the town, lived entirely to themselves. They were symbols of capitalism and they were disliked. When they went broke nobody was sorry."**

**To be liked and understood, modern management must tear down its iron fences and live in the town**

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Of course, not all these "good" towns of ours boast all the good traits I have mentioned nor are they uniform in degree. Many "good" towns were not included in this study; some of them may be more worthy than those chosen. But the towns cited are typical, and as such they should yield us a glimpse of some of the principles that appear to be basic in good community industrial relations.

Not everything you will read in these pages will be complimentary to the cities mentioned. I hope you will agree that it is possible to admire the lines of a ship without being blind to its seams. And remember, the opinions expressed are the author's own, based on an honest attempt to resolve the opinions of people who do not always agree among themselves.

You will see, in these sketches, that good public relations is as old as the hills, that it flourished, here and there, long before anybody put a name to it.

**This article considers only the brand of human relations we may expect to find in the industrial town of tomorrow. It contains not one word to indicate what the town will look like. Our thought in that connection is that we'll do well to leave its physical appearance to someone like Norman Bel Geddes, who has lots of ideas and has been given a chance to express them in the General Motors Highways and Horizons exhibit at the New York World's Fair. So here's his conception of the city of 1960, as it looks to the thousands of people who each day ride the moving sound chairs**

## MIDDLETOWN

I found Middletown very proud of the local baseball team's victory over a major league club, under floodlights at the fine Armco field, but even more proud of a citizenship rally at which 500 townspeople saluted seventeen eager new citizens. Mister George M. Verity was there and made a speech. So did various merchants, lawyers, innkeepers, and other good members of the citizenship committee.

Middletown (population 35,000) has few foreign-born (2.5 per cent). Most men in Mr. Verity's position wouldn't have bothered. This gives you the idea back of Armco's "grass roots" public relations policy. Mr. Verity wasn't the only big attraction at the rally. The seventeen new citizens shared the limelight. The company didn't run the affair. The committee did.

Of course, you can't talk about Middletown without talking about Armco, which employs 60 per cent of the town's industrial help. But it's no "company town." Armco officials participate in civic projects simply as townspeople. They are much respected, but inspire no awe. Only Chairman Verity gets a "Mister" from his fellow-citizens. It's just "Charlie" Hook (President) and "Charlie" Murray (Assistant to the President in Charge of Personal Relations) and "Leo" Reinartz (Works Manager).

Physically, Middletown is a reproach to all "steel towns" and a model for almost any town. Its biggest homes are unpretentious, its slums few. It has fewer *big* incomes than, but almost twice as many *good* incomes as a much bigger town not far away. Its relief load is half that of a nearby town of the same size. Home ownership is 58 per cent (national average 48). Autos, radios, electric meters, well above average. Telephones phenomenally so.

In Middletown the lines that usually divide the several elements of community life—industry, business, the professions, labor, social work—have been all but erased. The town has a tidy, economical city-manager government. All organizations, from the Merchants Association to the Girl Scouts, tie into the unique Middletown Civic Association which combines the functions of community chest and chamber of commerce at lower cost. Annual drives are "out." All Middletown simply pays dues (about equal to one hour's pay per person per month) to the Association which parcels the money out community chest-wise to the social agencies. Its Family Service Bureau handles home relief, makes WPA placements.

### Never Lost a Day

Armco wages are the highest in steel. They tend to lift levels a bit in most but not all of Middletown's eighteen smaller plants. Armco policies (group insurance, mutual benefit funds, safety and health work, foreman training, care in handling lay-offs, and extensive employee and public information programs) stand out in Middletown, in steel, and in all industry. The company has never lost a day in strikes. Its long relationship with the old Amalgamated Steel Workers ended in 1928, when the union called a strike which the management believed was in violation of a contract. Only 17 men went out. After NRA the men reorganized their advisory committee, established in 1904, into an employee representation plan. CIO made no dent in Armco at Middletown, and, at the company's Butler, Pa., plant, lost the only NLRB election of its steel career, 3 to 1.

Armco employees receive weekly bulletins like a Washington news letter, giving the low-down on conditions in the industry and on the company's own

operations and prospects. Townspeople get similar information from the company and through the urban and well-edited *Middletown Journal.* This includes ample warning of lay-offs, such as that occasioned by the dismantling of the hot strip mill to make way for a wonder-working new one. Employees are proud of the company's big research expenditures, love to tell how Charles R. Hook backed John Tytus, a mill employee, who is now vice-president in charge of operations, with cash and confidence until the revolutionary continuous rolling mill was developed.

Public opinion, won Armco's way, will stay with you in any crisis. Middletown is wholly sold on Armco and on all industry—oversold really, for there were unfortunate overtones of vigilantism during the Lorillard Tobacco strike. one of Middletown's very few, last year.

*Middletown notes:* Mr. Verity runs a dairy farm as a hobby. But in the larder of the handsome hospital (to which he has made large contributions) there is none of his milk. Somebody underbid him apparently . . . Middletown's three swimming pools, the beautiful Armco Park, the golf course (no country club, just a golf course) make it tops in recreation . . . Seeking to discover "company town" traits, I told a druggist I was a traveling salesman who knew a young doctor looking for a place to practice. I asked whether you had to have an "in" with Armco to get patients and a place in the hospital. The answer: "Heck, no. But we've got plenty of doctors" . . . I got to talking with an Armco roller, over a glass of beer. "I been with the rolling mill 18 years—just a beginner," he said. "My father has worked there 33 years and my father-in-law, he just retired. Owns his house, gets $40 a month, has his insurance all paid up."

## DAYTON

Among intensely industrialized cities of its size, Dayton (population 212,000) has a non-major strike record that is probably unique. Dayton management is inclined to look heavenward when you ask why.

"It's like just so much good weather," said a plant executive. "We just thank God and hope for more of the same."

Others averred it wasn't any accident and expressed no apprehension at all.

Many said good management was regarded in Dayton as a preventive measure, not as a cure.

"We've a backlog of old, conservative German stock here," said some.

AFL has a certain ancient strength in Dayton. But even at the height of the organizing drive, CIO pamphlets lay crumpled on the ground outside the plants. This town is conservative to the core. The Germanic backlog theory seems to satisfy a lot of people.

"Huh," said a business man. "Didn't you ever hear of John H. Patterson? As head of National Cash Register, he did more for Dayton and perhaps for industrial relations in America than any man of his time.

"He built the first daylight factory, when factories were red brick with narrow windows. He painted everything white inside. He pioneered in health work, safety, bulletin boards, suggestion systems, public plant tours, the 'open house.' He established night

schools, provided books, teachers, and a place to meet. At least twice a week he went through the plant and talked to the men at their benches. He encouraged neighborhood gardening, formed 'boys' brigades,' gave the kids health education and entertainment. Maybe this was paternalism, but it did a lot of good. I was one of the kids and I know.

"In the 1913 flood, Cash began making rowboats seven hours after the waters rose. Soon they were turning out a rowboat every three minutes. In the office building they baked 4,000 loaves of bread a day. Anybody who took in refugees—we had 23—got supplies from the National Cash Register Company. They say Mr. Patterson was $2,000,000 out of pocket personally after the flood. I believe it.

### Saved the City

"Downtown he worked constantly for civic improvement. He headed the charter committee that brought Dayton the city-manager plan. He helped lay the plans for the Conservancy Commission whose dams saved the city from the worst of the 1937 floods. NCR's present president and chairman, Colonel E. A. Deeds, directed this work and saw it through.

"In every plant in Dayton today, there are executives who have worked either for Mr. Patterson or for men who worked under him and so absorbed some of his philosophy."

Later I found Dayton men doing standout public relations jobs in cities far from Dayton.

The story of Dayton's industrial growth shows the overwhelming part that fate can play in the lives of mere men who organize chambers of commerce to attract new industries. Dayton was the birthplace of the airplane, but the aviation industry left home before it came of age. However, Charles F. Kettering was brought to Dayton by Colonel Deeds and put to work at NCR for which he produced some important inventions. They say Kettering was working on a cash register motor when he decided that automobiles should have self-starters. Hence Delco and the presence in Dayton of the largest operations, outside Detroit, of the General Motors Corporation which eventuated, in part, under the financial ministrations of Colonel Deeds.

GM (Frigidaire, Delco, Inland, and several smaller units) and NCR between them employ a good half of the town's industrial working force. Dayton reacts acutely to depressions, but appears to be one of the few cities whose industries can absorb the unemployed in times as good as 1937.

Major managements are working hard to level out production peaks. Wages are high in the big plants and better-than-average in all but the smallest of the others. Said an elderly sweeper from Frigidaire whom I met on a bus: "We had overtime today and I made $7. I kin remember when I had to work a week for that."

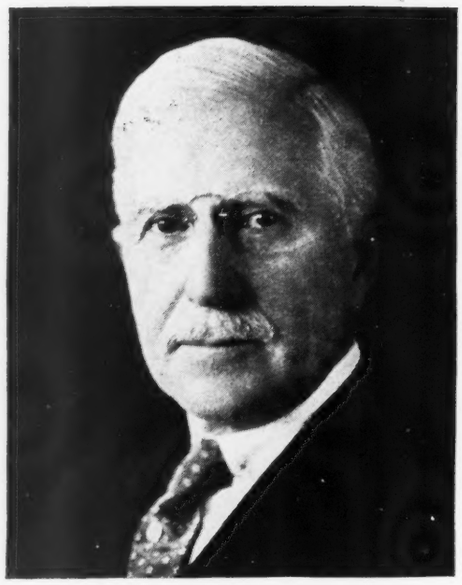
Dayton's confidence in industry is great, but its faith in home ownership was cruelly shaken by the 1932 building-and-loan crashes (Dayton was never a "bank town") and a $100,000,000 mess that hasn't been cleaned up yet.

"That should have made radicals out of these people, if anything could," said a newspaperman.

But even the CIO leaders are conservative. One, an employed worker, issued this war cry:

"We know our jobs depend on profits. We just want enough to buy the things that make jobs. Gosh, maybe if I had a million dollars, I wouldn't want a union in my plant, either."

CIO insists it is making progress, but so far has only one contract with a plant of good size. Ultimately it may catch up with and organize Dayton's workers, although both are now proceeding, like the dog that chased the jack-rabbit in the Arizona heat wave, at a walk. If CIO does win, it will win in an atmosphere of comparative peace, which is more than can be said of most of the cities where it did win.



**GEORGE M. VERITY**
*Chairman, The American Rolling Mill Company*

Dayton is a handsome town of friendly, talkative people, wide streets, fine public buildings. There is plenty of sub-standard housing, but actual slums are not as bad as most. Of late years, the civic spirit has shifted somewhat from the industrial managements to the downtown factors. The newspaper situation is healthy. Former Governor James M. Cox's big, stolid *Daily News* meets with enough competition in Lewis Rock's *Herald* to stir up a bit of civic crusading. Tax rate, bonded debt, death rate, and crime rate all low. A bang-up Community Chest and a very intelligent Chamber of Commerce.

## TOLEDO

In 1805, the white man and the Indian made a peace treaty in a stockade, thoughtfully named Fort Necessity, at the head of the Maumee River on the shores of Lake Erie. Here, 120 years later, flourished Toledo (population 300,000) busy in the making of automobiles, auto parts, glass, machine tools, toys—a big railroad center and the nation's largest coal port.

Came the depression. Amid the crash of falling banks and the clangor of closing factory gates, the whoops of warring labor braves rose in a constant crescendo that curdled the dreams of management men 2,000 miles away. The debt-ridden city government staggered blindly, giving no guidance to a badly bewildered people but issuing lots of scrip.

Low-wage, open-shop Toledo got it first and got it in the neck in all the ways that adversity can afflict a city. It was a sort of industrial Job, reeling under the successive impacts of financial and commercial collapse, hell-bent unionism, strike riots, and, being first in so many of these things, extremely sensational publicity. Long-smoldering labor unrest was fanned by the bank

**"Good public relations is nothing more than good human relations multiplied endlessly. What we need in business is to understand people better. Industry must study men with the same care that in the past it has studied materials and methods. . . . A sound public relations program has its basis in sound management policies and sound management practices. It must provide actual, measurable benefits for employees, community, suppliers, customers. Only thus can it serve most profitably the owners of business"—*Paul Garrett, Director of Public Relations, General Motors Corporation, at McGraw-Hill Public Relations Forum, New York***

**"We decided 40 years ago at Armco that we couldn't ask for the respect, good will, and support of the national public until we had first won the good will of our own working organization and the people of our own home town," said Mr. Verity in a statement specially prepared for FACTORY. "We knew we could never succeed in this unless our own employees were fairly compensated, efficient and loyal, and provided with every sound incentive to do their best work. We did not, however, ever subscribe to 'paternalism,' the idea of 'the strong helping the weak.' We did foster 'cooperation,' the idea of every individual giving his best in partnership with the company in an effort toward a common goal.**

**"In the interest of a better understanding we have given to the public and to our employees, fully and frankly, all the information we could about our company's affairs, and about our problems and policies. Our fellow-citizens, in return, have shown a keen interest in the company's welfare. This we have welcomed because indirectly our problems are their problems.**

**"This program has paid dividends in the form of four decades of harmonious and productive industrial activity, uninterrupted by costly strife. Our policies have stood not only the test of time but also the test of application in all the other communities, outside Middletown, in which we have operated. It is certainly more economical for an industry to operate in a well-organized and forward-looking community than in a poorly organized one.**

**"Cooperation will succeed when it is undertaken *not* in a spirit of 'How little can we get by with?' but of *'How much can we do?'* It is the American way, the democratic way, the economic way, the practical way—the only way to new achievement for private enterprise and community progress. And cooperation begins at home."**

failures, the plant shutdowns, the city's early bungling of relief. Maybe this has nothing to do with it, but a former auto worker, describing the Toledo of twenty years ago, said: "I seen it with my own eyes—men clamoring at the gates for work and fourteen carloads of Southerners coming into town for jobs." Anyway, Toledo became, almost overnight, one of the most heavily unionized towns in the country. Furthermore, as a "bottleneck" in the automobile industry, it lay directly in the path of CIO's first big barrage.

### A Civic Fort Necessity

In 1935, the people of Toledo erected a civic Fort Necessity just in time to save the city's fast-famishing industries from catastrophe. This took the form of the now celebrated Toledo Plan which was really just a name for a sudden and dazzling rebirth of the civic spirit.

The Toledo Plan had two main aims, the rehabilitation of the municipal government and the restoration of peace and order to labor affairs. In its essence it was a public relations maneuver, designed to restore the city's fair name, thus to halt the depletion of its industries, and, mayhap eventually, to attract new ones. In short, to remove the label of "Ghost Town" and replace it with "The Town that Came Back."

Well, it did. The supporting facts and figures defy inclusion in this space, but I ask to be believed when I say that 1939 Toledo has more than tied the score. Teamwork, spirit, determination have replaced despair. Tangible achievement, industrially and socially, has been the result. I wish it were possible to call the roll of some of the personalities whose leadership brought this about. They represent an amazingly fortunate coalition of new industrial management blood, business and professional people, and the latter-day scientists of government. Best known names: John D. Biggers, Hubert Bennett, Harold Anderson, Robert A. Stranahan, Royce G. Martin, Ward M. Canaday, all from industry; Dr. O. Garfield Jones, political science professor of Toledo University, President Phillip C. Nash, of the University, the Most Reverend Karl J. Alter, Catholic Bishop, and two outstanding editors, Grove Patterson of the *Toledo Blade* and Carlton K. Matson, then of the *Toledo News-Bee* now of Libbey-Owens-Ford, representing other elements in the social structure.

They put through a new city charter, John N. Edy, a former assistant director of the United States Budget, was installed as city manager. He quickly set about sprucing up the city's drooping finances and putting the dilapidated municipal services back on a paying basis. (When I was there, people were grumbling about traffic delays caused by street repairs. In the old days they used to walk in fear of falling into the holes that pocked the main thoroughfares.)

Meanwhile Edward F. McGrady, then star trouble-shooter and Assistant Secretary of the Labor Department, mopped his brow after averting a power strike and remarked that he was tired of commuting to Toledo. He proposed that a local agency be set up to mediate disputes. Thus was born the Toledo Industrial Peace Board, composed of representatives of labor, management, and the public. The Board serves an advisory function, backing up a professional mediator who works full-time and is paid by the city. Ralph Lind, now a well-known labor relations consultant, was the first chairman. He did splendid work before turning the mediation job over to amiable, able, tireless Edmund C. Ruffin, a former labor reporter for the *News-Bee*.

Although the Board and its conciliator lack arbitrary powers of any kind, they have done a real job. The score, from July, 1935, to August, 1939, is: Disputes settled without strikes, 140; strikes settled, 47; lockouts settled, 1. Labor is cooperating. Man-days lost in strikes have fallen off sharply.

In the plants, meanwhile, good management practice was being pushed, efforts to level out production were getting results, and costly researches were creating new jobs. All this gave Toledo something to talk about. So Toledo Associates, a non-profit public relations association, was formed with the backing of the town's principal industries. An alert young advertising man, Joseph K. Close, was retained. He daily pumps reams of good news about Toledo into the channels of the nation's news.

Toledo's story isn't all told as yet. It still has strikes. It still must combat the unrest and resentment of the past. Labor has been making steady gains for five years now, however, and management is beginning to stiffen. But Toledo will face no problem, I believe, that its fully aroused civic spirit can't solve.

## SOUTH BEND

The civic spirit is astir in South Bend (population 109,000), and the town is wide awake.

Here is a city that, lacking Dayton's distinguished management history and resembling Toledo in its industrial make-up, landed somewhere between the two in the post-depression disturbances and emerged, after some travail, in a very favorable position. Factors that helped it over the rough spots were a stable city government, good relief policies, and a fairly good management background.

South Bend's total industrial employment now exceeds that of 1930. Industrial payrolls are nearly three times those of 1933. Between 1937 and 1938,

the city trimmed its strike losses from 35,905 man-days to 4,301. At one time the town seemed likely to lose industries but the danger is now past. A rather prolonged strike, centering around the recognition issue, ended a short time ago.

Industrial management has done much to revitalize South Bend's extremely alert Association of Commerce with its well-conceived Civic Promotion Division program, its Safety Council traffic drive (when I was there, they were celebrating a record of "100 Deathless Days" on the highways), and likewise its effective work in keeping the coolest heads of management and labor together.

With labor peace largely assured, South Bend is going aggressively after new industries, was engaged, during my visit, in raising a fund for the purpose. They say that when the committee was formed, a management leader pointed out that organized labor wasn't represented. The omission was quickly rectified. Some time ago, a Commerce Association group was trying to dissuade a manufacturer from expanding his operations outside South Bend. Merchants and civic leaders all said their pieces. But it was a factory worker, not even a union officer, who broke up the ball game.

"Heck, Mr. ————," he cried. "We don't like labor trouble either. Sure, we stopped work at our plant one day. Know why? Because an inspector was trying to pass some bad work."

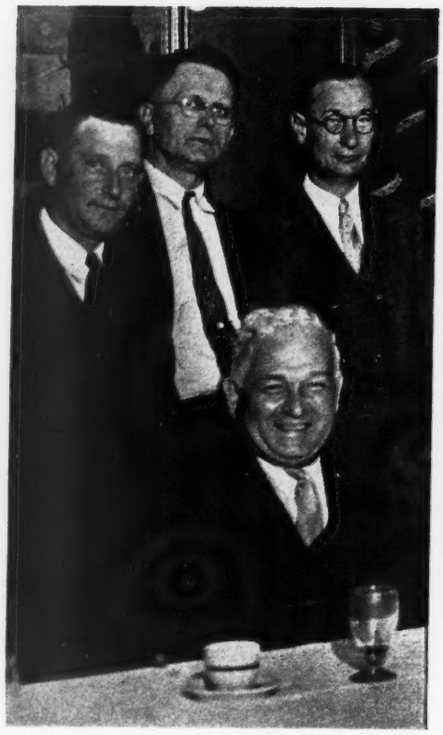
They say this statement turned the trick. Note well that unionized workers were invited to a conference of this kind. I found another strong ally of business and management in the person of one of the city's most influential CIO officers. He gave me a "pep talk" that would have done credit to the town's leading banker, concluding:

"Industry can move here with the absolute assurance that employers can talk to their employees and that an understanding can always be reached at the conference table."

I think he's right. Management men say South Bend workers are intelligent and level-headed. Of mixed native and foreign origin, they took to industrial unionism quickly but quietly. Many of the native-born, coming from the coal regions further South, were born to the union tradition. Among other groups, the churches of every faith encouraged union membership, though counselling restraint. Essentially the people are conservative—and great home-owners (60 per cent.)

Confidence in management has been bolstered mightily by the achievements of the relatively new top management of South Bend's oldest and largest industry, The Studebaker Corporation. The leadership of H. S. Vance, Chairman, and Paul G. Hoffman, President, has meant thousands of jobs to South Bend, and South Bend knows it. Sales of the "Champion" kept the plant busy five-and-a-half days a week right through June. Retail business leaped ahead 18 per cent, new-car sales 184 per cent, construction 23.6 per cent —all far above the nation's average gains. Relief costs fell off. Such signs are visible to all.

Studebaker itself is a puzzle to the advocate of formalized personnel programs. Wages are about average for the industry. For its wage earners there are no pensions, bonuses, paid vacations, or



extensive employee information plans. But, lacking the form, Studebaker seems to have the essence of good management. Morale is excellent. The company has lost only two-and-a-half hours' production in labor disputes, has never faced a NLRB charge, has (alone in the industry) retained piece rates. Only elected union officers from the plant meet with the management in negotiations. There is no closed shop or check-off, but union membership is solidly united, has no factional fights.

"Never mind the bonuses and fancy vacations," an officer of Studebaker Local Five, United Auto Workers, told me. "Just give us fair pay and a square management like this one."

The fact is that the men *know* the present Studebaker management as, years ago, many of them knew the Studebakers in their wagon-making days. They recall an occasion when Hoffman, new as president, heard that the men were "knocking" the cars even as they built them. He went down into the plant, said: "If there's anything wrong with the cars, let's fix 'em. If not, let's sell 'em." This appealed to their innate pride of workmanship. They "sell em" now.

The Studebaker attitude is considered a strong influence for South Bend labor peace. With the advent of General Motors management at the big Bendix plants, the citizens look for continued peace there, too.

South Bend has no city manager, but

✦ ✦ ✦

**We have no ideal cities—yet. But certain cities *can* claim outstanding records of industrial harmony**

**The best towns I saw were those where industrial management has accomplished the most in good public relations**

**I am going to stick my neck out and state categorically that the towns that were hit hardest by labor trouble were those that had the worst management backgrounds—*and vice versa***

**With good public relations, management can get along with a good union leadership, or, if need be, take the men right away from a leadership that becomes high-handed and unreasonable**

**When you're sure your labor relations and your community relations are sound, there is plenty of time to start telling people what a fine company you have. And then, don't fail to do so**

**Here is another important characteristic of "good" towns. In almost all of them I found strong newspapers, independent and progressive, with news and editorial columns open to both sides of a controversy**

**The opinion of the people of Toledo is back of this Industrial Peace Board, formed to provide a "safety valve" for industrial unrest. Management, labor, business, the professions, and the churches are represented in this advisory group which supports the effective mediation work of Edmund C. Ruffin, the city's "secretary of labor." Edward F. McGrady, former U. S. Assistant Secretary of Labor (third from right, seated) was the idea's first sponsor and Ralph Lind (fourth from right) was the first chairman**

its mayor-and-council administration is economical and clean. Tax rate, bonded debt, and death rate are low, and city services are efficient. The Community Chest is now being reorganized along modern and progressive lines. The town stands well in automobile and radio ownership and other indications of average prosperity. A good newspaper, *The Tribune*, aids civic projects and treats news fairly. I think South Bend is going straight ahead.

## EVANSVILLE

Evansville, one of Indiana's older industrial cities (population 112,000), fell behind for a time when some of its earlier industries, such as furniture factories and stove works, faded away. Even in 1929 the town had less than 15,000 industrially employed. In the depression it sagged still lower.

Since then Evansville has snapped back—faster, perhaps, than any city of its size. New modern goods industries, automobiles, refrigerators, electrical goods, moved in. By 1937 industrial employment had hit a peak total of 24,513, which it may surpass this year.

In its growth Evansville proved to be neither union-proof nor strike-proof, despite a quiet history and a population backlog of calm, conservative Germans. Perhaps that interval of comparative stagnation had something to do with it, although this, in turn, may have set the stage for a come-back. (I was told that some new industries were attracted by a surplus of skilled workers willing to take small wages.) Perhaps the breakdown of the Community Fund was a factor. Anyway, CIO moved in, too.

Like South Bend, Evansville escaped the wracking tortures of Toledo, but the presence of growing unrest was evident enough to call for action of some sort. In 1937 a public relations program was instituted by the Evansville Cooperative League. Between that year and 1938, Evansville trimmed its strikes from 21,077 man-days to 4,116, a notably better reduction than the national average.

What is the Evansville Cooperative League, and what does it do? Its sponsors are fourteen major manufacturers. They make improved industrial relations the basis of their program, industrial peace their aim. The movement began with group meetings of employers for discussion of better personnel methods, working conditions, employment stabilization, and so forth. In the spring of 1937 they launched a vigorous public information campaign designed to offset attacks on industry by "radical labor leaders, politicians, and alien groups with unworkable panaceas." Aim of the campaign was to hammer home the importance of industry to the community, the advantage of the American system over the "isms," the relationship of wages to dividends and profits, the dangers of excessive taxation, the meaning of "hidden" taxes.

With an initial budget of $50,000, since reduced, the League has published 200 newspaper advertisements, mailed 113,000 circulars, broadcast 165 radio programs, brought outstanding speakers to the city, arranged group meetings at which employers placed their viewpoint before merchants, ministers, teachers and farmers, and conducted an essay contest on "A Platform for Industrial Peace," published a series of newspaper stories on personnel activities in Evansville plants.

One of the most interesting of the League's publications was a seven-point "quiz" for employers and employees, inviting both to take inventory of themselves. Employees were asked to consider whether they were giving a full day's work for a full day's pay, whether they were interested in their company's

success, as well as their own. Employers were asked whether they were paying fair wages and whether they took employees into their confidence when changes were made.

To evaluate the League's program, I asked the opinion of public-relations-conscious management men in other cities. They had some friendly criticism to make, but added: "Anything that draws employers closer together and encourages them to talk and think about better industrial relations is all to the good."

The most solid fundamental achievement of the League appears to be this development of the "social conscience" among Evansville employers of all types. Thomas J. Morton, Jr., Chairman of the League, reporting in FACTORY, December, 1938, said:

"Unquestionably, Evansville is today a better place for the wage earner to hold his job than it was a year ago . . . Local employers are more alert to detect injustice in their dealings with their people, more eager to correct faults . . . Wages in a few backward businesses have come up to parity."

### Leveling Out Production

Meanwhile in many plants, notably at Servel, Inc., real work was being done to level out production and combat seasonal lay-offs. Manufacturers gave freely of their time, not only to meetings and speeches in the League's behalf, but to civic activity, especially to reviving the Community Fund which, between 1927 and 1934, had been disbanded.

Whether Evansville's signal reduction in strikes from 1937 to 1938 was due to increased wages and improved industrial relations, or to the public information program is a matter for debate. The League can take a bow for it either way. Evansville differs sharply from Toledo and South Bend in that its industrial union elements have not been enlisted in the public relations program. (Mr. Morton relates that CIO first offered to cooperate, then withdrew from a scheduled meeting.) The local CIO leadership now holds the League's publicity to be "anti-union propaganda" and calls the League "fascist."

If feeling is not of the best, at least the battle is an open one (from the start, the League has made a point of sailing under its own colors), and it's a game that two can play. CIO held its Indiana state convention in Evansville this year and thus brought its viewpoint to public notice locally. It is also planning to post billboards on the highways urging workers to join the CIO and "take the road to better living."

An extremely interesting town. Will industrial peace continue to prevail? One strike occurred this year (a minority strike, they say) at one of the biggest plants, and there is "Homer Martin trouble" in some of the auto plants, a situation over which Evansville has no control, of course. Is the publicity program a factor for peace, as some say, or, as others contend, an irritation? Time will tell whether Evansville has found the final formula for industrial harmony, but its present progress must be set down as measurable and noteworthy.

In other fields, Evansville has accomplished much, but much remains to be done. The Community Fund is well established, but its *per capita* contributions are still below par. The city government is "solvent but not distinguished," as one citizen put it, and the death rate and infant mortality rate are far too high. Home ownership is average, but substandard housing is plentiful. In the possession of automobiles, radios, telephones, electric meters, Evansville is a bit above the national par and a bit below the "best towns" mentioned in this survey.

The people are literate and generally level-headed, and the newspapers, especially the lively and informative Scripps-Howard *Press*, are progressive. There is so much drive behind the chief management influences and the town is gaining so fast industrially that the complete re-awakening of Evansville's civic spirit seems only a matter of time.

**"It is neither possible nor desirable for an industry to divorce itself from the community in which it operates," said Mr. Graham when asked by FACTORY to comment on this article. "Management's public relations problem is largely a community problem. It is a matter of both public interest and self-interest for management to reach a balance of harmony with its employees, its stockholders, its customers (many of whom are employees and stockholders), and the people of the community. Such balance, once established, assures an industry of the good will and respect of the general public within and beyond the sphere of its operations.**

**"Don't make the mistake of assuming that a public relations program can succeed without a sound formation of good industrial relations. It is time enough to seek community good will after management has achieved a record of impartial justice within its own house.**

**"Management also faces a certain definite responsibility toward the community of which it is a part. It must be active in civic and public affairs as an indication of its own 'good citizenship.' We all suffer as citizens when we neglect the duties of citizenship.**

**"It is just plain common sense as well as good business for management to take an active interest in the schools, churches, health, housing, tax rates, bonded indebtedness, and general welfare of the community. If the community fails to carry out its social and economic obligations, then industry must shoulder an extra burden. Management must work actively to maintain good community conditions and improve unfavorable ones.**

**"All these things bear mutually upon the community's welfare, the welfare of the industry within the community, and the ultimate success of the two."**

## KINGSPORT

Cows grazed, 25 years ago, on the site of the landscaped traffic circle at the head of Broad Street where today a cluster of churches and other handsome public buildings surrounds a stream of steadily flowing traffic. And that's the story of pretty, booming Kingsport, Tenn., not long ago a drowsy hamlet on the banks of the Holston River, too small to merit mention in the census figures of the 1910 World Almanac.

Today the smoke of nine good-sized industrial plants floats down the valley where the Clinchfield Railroad shuttles ceaselessly about with loads of freight and fuel. Some 8,000 people are getting their living in these plants, people who, by and large, are getting their living in industry for the first time.

Kingsport grew thus: 1920, 5,692; 1930, 11,914; 1939 (City Recorder's estimate), 17,000 plus 10,000 more in the immediate area.

Here private enterprise has had a fling at the "planned economy." In 1915, the physical growth of Kingsport was blueprinted by Dr. John Nolen, the most eminent city planning engineer of his day. At the same time, the Rockefeller Foundation's research bureau formulated the charter for a model city-manager government.

In the South especially, the impact of industry upon aging communities leaves few pretty pictures. What you see, as a rule, is a business district of narrow, crooked, bumpy streets, flanked by dusty, red-brick buildings, and an untidy jumble of factories, slums, and homes.

But in Kingsport the factories stand

**T. G. GRAHAM**
*Vice-President, The B. F. Goodrich Company*

isolated on the river bank while the residential sections radiate from the business district in a definitely geometrical pattern. There are streets in this town that need yield nothing to Larchmont or Shaker Heights.

When you ask how all this came to pass, the man you hear about is J. Fred Johnson. Years ago, he "kept store" in town. Today a modern department store on Broad Street bears his name, but it is only one of the many enterprises in which he has a hand. Woven tightly into the fabric of the town's economic lift is the Kingsport Improvement Company, of which he is the active head.

Kingsport is the only town I saw that has no chamber of commerce. But most citizens are satisfied to relate that bluff, genial, persuasive "J. Fred" is a master salesman, an organizer without peer, and a postively magnetic attraction to new industries. Kingsport owes much, they say, to John B. Dennis, a former New York banker whose efforts made possible the completion of the Clinchfield Railroad. But Johnson is the fellow they talk about most. They are fond of telling how once he conducted a visiting industrialist through a country school where a little child rose unbidden and said the words that clinched a deal.

Some southern cities, and whole states, bait their hooks with tax exemptions and other glowing inducements. The Kingsport Improvement Company has ceded 370 acres of land to incoming industries, but these now pay 40 per cent of the town's taxes. City officials say that when a northern industrialist talks of tax exemptions, they question his good citizenship.

If the presence in Kingsport of the Tennessee Eastman Corporation were Johnson's only achievement, he could rest on his laurels forever. This affiliate of Eastman Kodak began making wood distillates for the Rochester film plant about 1920, and then branched out into rayons and plastics on its own account. Kingsport has Tennessee Eastman to thank for the fact that it hardly felt the depression of the early Thirties. In 1930 Tennessee Eastman had 700 employees; today it has over 4,000. The company has been building steadily on its park-like factory grounds, at times employing as many as 1,000 construction workers.

The outstanding management policies of Eastman, including wage dividends, (profit sharing) annuities, medical service, sick and death benefits, and vacations with pay, have had a beneficial effect on the town's general welfare. Eastman wages and those paid by the Kingsport Press tend to peg Kingsport levels up a bit, since these two plants between them employ a majority of the town's industrial workers. Wages are low in some of the lesser plants, however. Most plants are on the 40-hour week.

### Right or Wrong

There are those in Kingsport who will deny hotly that low wages are paid anywhere in town. Kingsport is intensely sensitive about its fair name. It reacted bitterly against a recent article published about it in *The Nation*, a radical paper, and it glowed over the praise bestowed upon it by another story in *Nation's Business*.

*Nation's Business* is right, it seems to me, when it calls Kingsport one of the country's most unusual cities, wrong when it estimates average wages at $1,300 a year, right when it says the relief load is light and the Community Chest annually over-subscribed, wrong when it says there is no need for Federal aid on housing.

*The Nation's* writer seemed a trifle naive in asserting that low wages are a Kingsport attraction for Kingsport wages are well above the Southern level. He put his finger on the town's real weak spot, however, when he pointed out the slum development that has sprung up on Long Island, an untidy area lacking streets, paving, and running water.

A good deal of low-cost building has been done outside the city, but not much inside. In the town a survey taken last spring found only 23 houses for rent. The need seems to be for homes costing less than $3,000. Two years ago, a development was launched, offering beautiful homes at $3,190 for four rooms, to $4,690 for six rooms, but the expected large sale of houses at these prices has not materialized.

Nearly half of the town's wage-earners live on farms, some as distant as 25 miles, but the town is growing so fast that housing will have to be undertaken or the human tendency to huddle around factories will defeat the designs of the city planners. Management seems aware of this, will probably do something about it.

Kingsport has known only one strike, years ago. The Textile Workers Organizing Committee has made claims at one plant where Labor Board elections have been ordered.

It seems too soon to tell whether Kingsport's industrial peace is assured for all time. It is a "new" town that has never had a depression in a section where industry is new. Many contend that the South is years behind the North in labor relations and will go through the process of unionization and strikes with local variations.

There is a covert struggle going on in Kingsport, the CIO throwing what support it could to an insurgent ticket in the last city election. The incumbents were backed by Johnson and most of the industrial managements and business people. The insurgents accused "J. Fred" of dictatorial methods, complained that the town was paying too much rent for the city hall, which is owned by the Improvement Company, demanded an end to the city automobile tax. The incumbents replied that the city hall rental was only two-and-a-half per cent of the building's cost. They won the election, which was hailed as Johnson's vindication, by 6 to 1.

Domestic use of electricity in Kingsport is 23 per cent above the national average. Two out of three residential customers of Kingsport Utilities have electric refrigerators. The town is well above the Tennessee average and close to the national par in automobiles, radios, and telephones. It is one of the

**"Essentially sound public relations begins fundamentally wit the forming of business policies and then with the industrial relations within each individual organization. . . . If individual enterprises do not win the favorable verdict of their own personnel, the people who come in contact with the customers and the public, there would seem to be little that any avenues of publicity or advocacy could accomplish. Sound industrial relations is a condition precedent to sound public relations"—*W. T. Holliday, President, The Standard Oil Company (Ohio), in an address before the McGraw-Hill Public Relations Forum, Cleveland***

outstanding industrial developments of today and its future will be watched with great interest.

* * *

As you have seen, there is something in these pages for those who believe that the best industrial towns are the non-union towns. And something for those who believe that unionism is no obstacle to effective public relations. In general it seems that industrial harmony can be achieved, with or without unionism, wherever major management has acted either to remove the causes of unrest or to repair the circumstances under which it grew.

Resentment can smolder unsuspected in a city for years before it bursts suddenly into strikes and violence. Chief causes are low wages, insecurity, bad working conditions, violent anti-labor activity. Sometimes "good" managements leave the door open to labor trouble by simply permitting too large a gap to exist between executives and employees, or neglecting employee information and foreman training.

Now I am going to stick my neck out and state categorically that the towns that were hit hardest by labor trouble were those that had the worst management backgrounds—and *vice versa*. I saw no town with a consistently good management record in all fields, but I did see towns where leading managements were visibly lifting the whole level of living (while a few "bad apples" were tending to drag it down.)

### Little of the Bitterness

In the "good" towns I encountered a minimum of the bitter anti-union activity typified by vigilantism, strike arsenals, big company police forces, rail-riding of organizers, and distorted press accounts of labor news—all things that we associate with the known plague spots of industrial relations.

"Such operations breed more unrest than they settle," said a plant manager of considerable standing. "Next to starting a sweatshop, there is no better way to invite the attention of labor's most reckless and radical organizers. And you're giving them something to work with, too."

What I *did* see was a tendency on the part of chambers of commerce and management leaders to "sell" good management to employers and to set up machinery, formal or informal, for the conciliation of disputes in a restrained and civilized manner. I saw also a good deal of the sort of "anti-union activity" that removes the wage earner beyond the organizers' reach by merely giving him more than a union can get for him. I saw managements that handled the union problem with the utmost skill, based on the utmost honesty, and had no trouble at all. With good public relations, management can get along with a good union leadership, or, if need be, take the men right away from a leadership that becomes high-handed and unreasonable.

Here is another important characteristic of "good" towns. In almost all of them I found strong newspapers, independent and progressive with news and editorial columns open to both sides of a controversy. In the best of these, I found plenty of industrial news—about plant expansion, production, sales, and *also* about layoffs, accidents, and other less pleasing matters.

Newspaper editors say that the smart managements don't withhold news. They know that frankness will kill the rumors that often do more damage than the facts. Smart managements go further and capitalize on the natural public interest in industry. They cultivate a friendly attitude by giving out plant news systematically. People know a lot about industry, anyway. They can usually tell you quite a bit about the products and operations of a city's principal plants. They also have a very clear idea of wage scales and working conditions, and don't you think they haven't. Public information is a vital part of public relations, therefore, but it will not stand alone. When you're sure your labor relations and your community relations are sound, there is plenty of time to start telling people what a fine company you have. And then, don't fail to do so.

Often I was told that a good community attitude was due to the fact that most of a city's people came of a certain racial stock—German, perhaps, or native American. But I don't think that's important. It may well be that, as a CIO organizer in Cincinnati said: "You can't make militant trade-unionists of these people; they're German and they don't get excited easily." But the same man pointed out that Germans are greater "joiners."

Later I saw extremely militant trade unions led by men of German descent. The backlog of the midwestern German immigrations, after all, was furnished by independent southern Germans who left their homeland in resentment at the Prussian oppressions. While not radical, they have a way of getting what they want. At any rate I saw cities where all the races of Europe were fused and they responded just as well as anybody else to good management practice and good public relations. As for the native-born, they have raised hell, unassisted, in countless towns.

It is more important to ask whether the people are *native to the city*. If so, they have roots in the place. If not, their economic position is less stable, and they tend to be less stable temperamentally. A common curse of the midwestern cities is the "southern influx" of some years ago which saddled them with a surplus of labor, much of it unskilled and ill-paid, and a big relief load. Earlier managements, seeking to keep wage scales down, were at fault in deliberately importing these people.

### Strong Factor for Peace

I was told also that diversification of industries, with resulting stability of employment and purchasing power, was a strong factor for industrial peace. This is obviously important. But not all-important. If it were, Milwaukee and Cincinnati would have no labor trouble, while Middletown and Dayton would have a lot of it. The so-called single-industry cities engaged in heavy goods manufacture and dependent on some other industry do suffer more, I believe, than those where the consumer goods lines predominate.

Again and again, in the "good" towns I was told of management efforts to stabilize employment by extensive research and sales promotion and by the risking of capital, if necessary, to build inventories and level out production. This is a big part of the public relations job, convincing evidence of management "good citizenship."

This takes us back again to the point that public faith in private enterprise is largely the reflection of management policies, that conservatism is a state of mind induced by confidence in the city's leadership, industrial and otherwise.

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**Next month, further specifications of tomorrow's industrial town will be drawn from examination of three more cities. What's back of Rochester's long history of labor peace? Has Cincinnati industry gained under good government? What's wrong in Milwaukee? Read the concluding half of this article in October *Factory***

# Why the Machine Tool Show of 1939 Is of National Significance

*An Editorial*

NEXT MONTH (October 4-13) an event of national significance—the Machine Tool Show of 1939—will take place in Cleveland.

Machine tools are properly called the "Master Tools of Industry." This descriptive expression evolved from the recognition of machine tools as the machines by which all other machines are made.

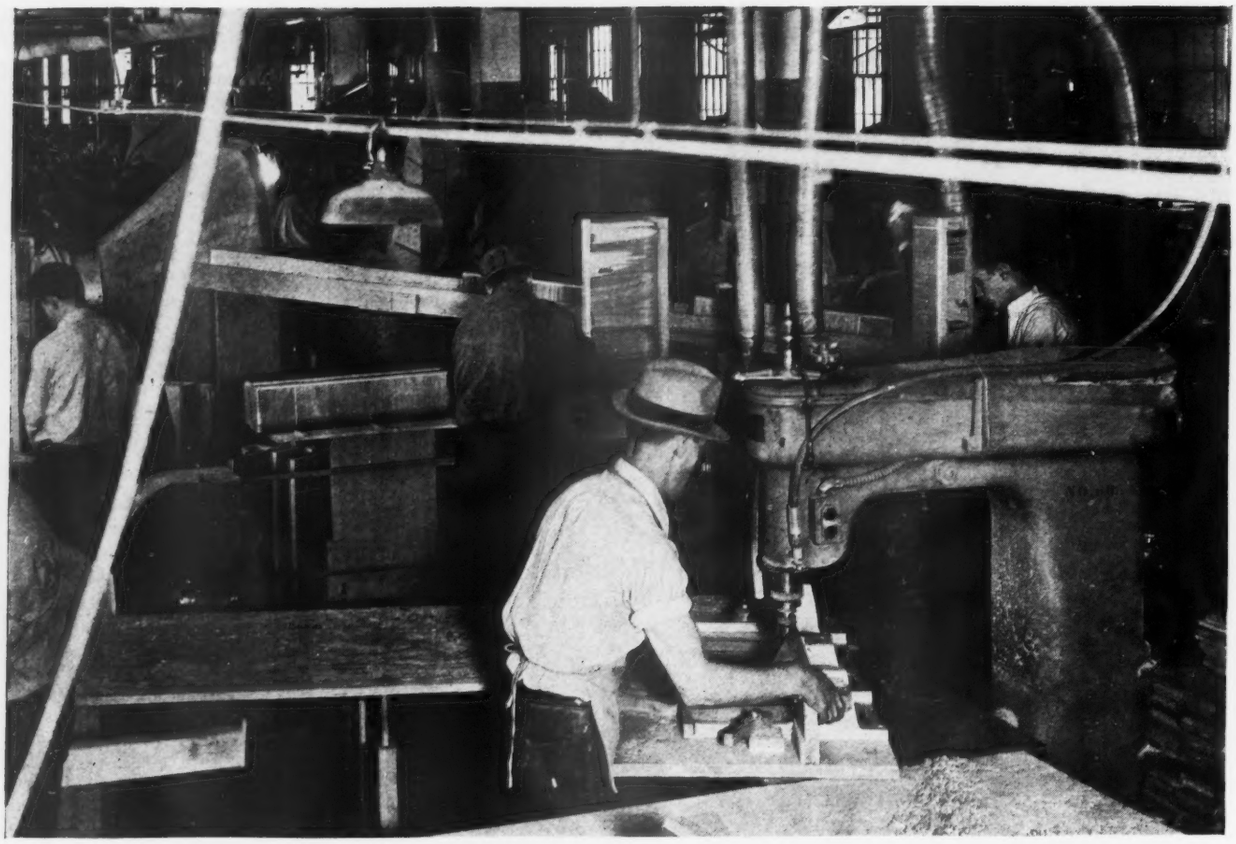
It signifies a great deal for one class of machines to be the means of making all other machines, because our present-day methods of living were born of the machine, and have been nurtured by the machine. Machines, and therefore machine tools, affect practically everything we have, and everything we do.

If all the people of this nation suddenly were projected back into the horse-and-buggy age, and if they took with them their present-day concepts of living, they would be helpless. Most of the ordinary, taken-for-granted things of today would be found not even to exist.

Quantity production is responsible for low consumer prices and therefore for the existing wide distribution of these taken-for-granted things. Quantity production depends upon interchangeability. Interchangeability depends upon precision. Precision depends upon machine tools. In the new and better machine tools of the show lie the possibilities for new and better machines of other kinds, new and better plant equipment of all kinds, new and better consumer products, and therefore still greater production and distribution. And that is of national significance.

But, also, this machine tool show of 1939 is nationally significant because the nation is at a turning point. The peak of popular distrust in the machine has been passed. American common sense is coming to the front. People are learning once again that the way to have more is to produce more; that machines make jobs instead of destroying them.

It is fortunate that this show of the master tools of industry is being staged just as the nation is waking from its dream of spending its way to prosperity. In its disillusionment the country will expect industry to make up for the time lost in experiments based on the theory of beneficent scarcity. So it is necessary that the inspiration, and the modernization, and the replacement that the show will engender should be gotten under way as speedily as possible.



**Now less non-productive handling time because materials are moved from one machine to next on gravity rollers or wooden slides**

# Short Runs Go Straight-Line

## Secret, if any, lies in stepping up machine flexibility and thereby cutting the high cost of layout change-over


**GUSTAV R. MAASS**

*Methods Engineer, Adler Manufacturing Company, Louisville*


IN SPITE OF SHORT RUNS, which may require bi-weekly dismantling and reconstruction of each production line, we're going "straight-line."

A large proportion of our manufacturing is done in lots normally considered too small to justify straight-line methods, but the direct and indirect labor savings of these methods, as applied to our operations, were so attractive that we determined to realize them by reducing the cost of change-overs through the medium of increased machine flexibility.

Most console radio cabinets consist of three to five sub-assemblies, each of which requires a number of machine and hand operations. These sub-assemblies are large and usually difficult to pile on skid platforms. Taking these pieces from skid platforms before each operation and repiling them after the operation, our old method, resulted in large amounts of non-productive labor. Cycle times of 0.30 minute were frequent, of which as little as 0.08 minute was consumed in cutting or other productive work.

By arranging our machines close to each other in the order in which the operations are performed, and by handling the material from one machine to the next on roller conveyors or wooden slides, this non-productive time

*Gustav R. Maass, caught here between changes in production lines, stepped from M.I.T. into James McCreery & Co., New York department store, as systems manager. On completing his job there, he went to work early in 1938 for the Factories Division of Sears, Roebuck. Has since been at Adler Manufacturing Company, the Sears radio cabinet plant*

has been minimized, with a substantial reduction in cost.

Don't think that this result is achieved by a permanent machine layout. It is not. The order of operations on each production line is peculiar to the model being made on that line and must be changed when the model is changed. Two or three models may be run over a line within a week, necessitating as many changes in machine and bench arrangement.

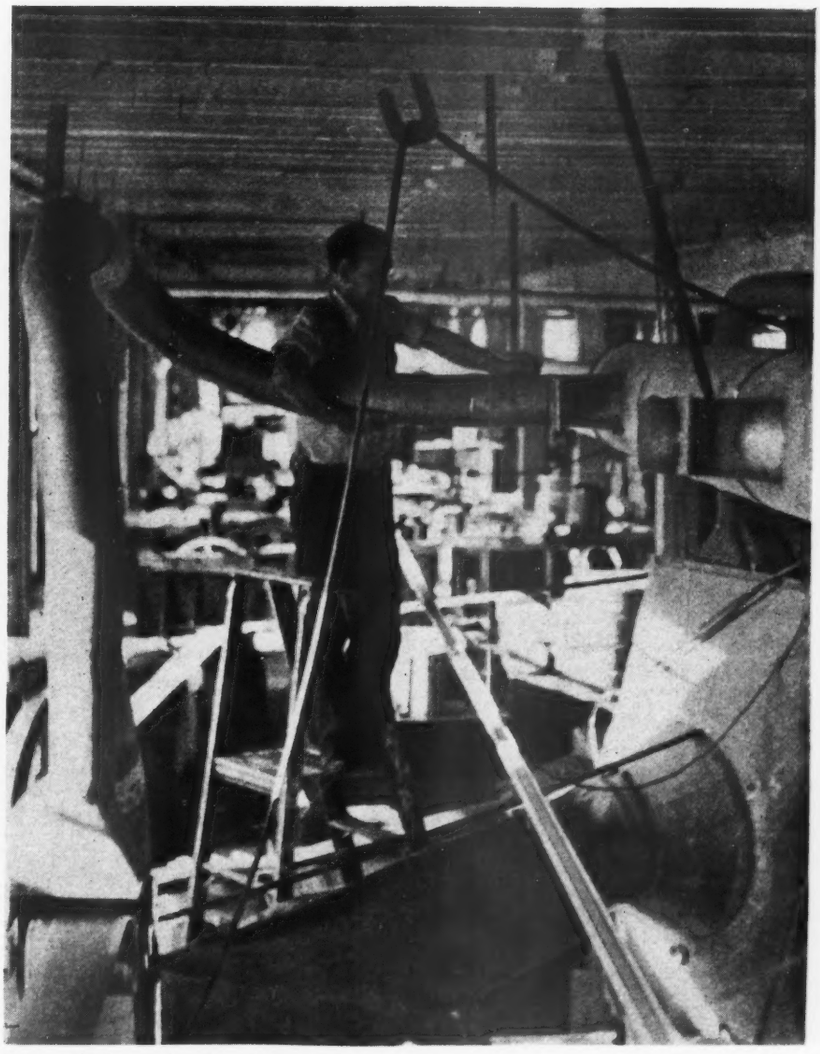
### Saving Time

Motion study brought out another important cause of operator handling time. The old method of assembling parts that were to be held with glue was to position them in a fixture, apply as many clamps as necessary, then remove the clamped parts from the fixture and place them on racks until the glue set. When set, the clamped assembly was taken from the rack, and the clamps were removed.

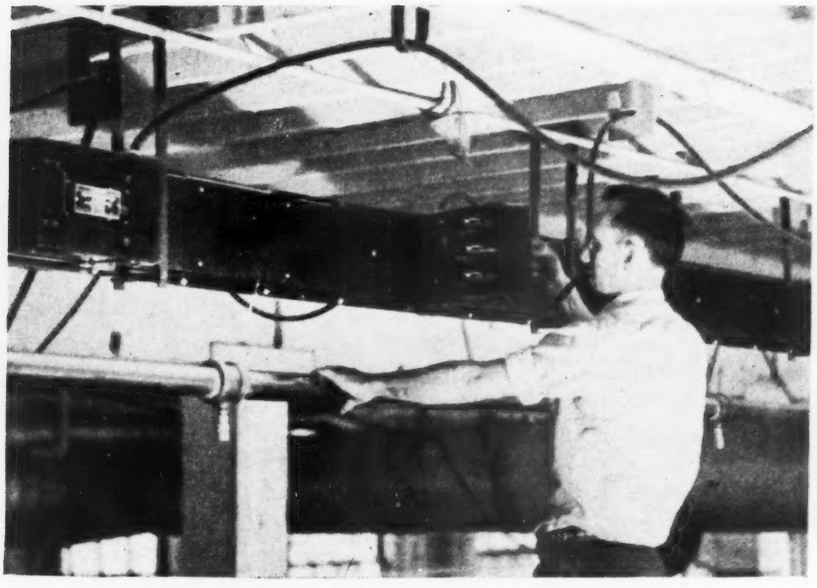
The non-productive time of racking and unracking, much of the time for placing the work in the fixture and removing it, and much of the clamp handling time are eliminated in straight-line operation by using fixtures that both position and clamp the work until dry, and which move through successive operations on a continuous loop of gravity roller conveyor.

The most obvious though not the most important result of straight-line operation was the elimination of trucking.

In the first model run by the new method, there was no trucking in the most important sub-assembly, which traveled 290 feet by conveyor and slide. If the assembly had been done by the old departmentalized method, it would have traveled 5,670 feet in 13 truck and 8 elevator moves, on three floors.



**Dust collection mains have 6-in. nipples at 3-ft. intervals; each machine has a length of metal hose—which makes it relatively simple to move a machine and hook it up again**



**A run of busbar through the production area solved the power problem. All the electrician has to do after a machine has been moved is climb his stepladder and plug in**

The reduction in trucking has, besides its effect on cost, a noticeable effect on quality. Radio cabinet parts and sub-assemblies are easily broken at many stages in their manufacture and easily marred at all stages. From this standpoint, moving singly on conveyor or slide is far superior to bumping over rough floors in skid loads.

Wrong dimensions in millwork and assembly are frequent sources of trouble in woodworking plants. Straight line is the answer to the inspector's prayer in detecting a defect of this kind, for the error can be made in only a few units before the first one reaches an inspection point or an opera-

*(Continued on page 122)*

# BUDGETING

**P. K. POULTON**

*With Talon for the past 10 years. Prior to that Mr. Poulton was with the New York Credit Men's Adjustment Bureau, also saw service with Irving Trust Company. Trained as an accountant, he began his industrial career as a cost clerk for Link-Belt, served later as statistician, U. S. Department of Labor; auditor, Gillespie-Eden Corporation; treasurer, Philippine Refining Corporation*

**P. H. GOLDSMITH**

*Before coming to Talon, Mr. Goldsmith worked with E. S. LaRose, controller of Bausch & Lomb, who has done much to clarify and expand the principles of budgetary control. His earlier industrial experience included a term as production manager, also with Bausch & Lomb, and another in the accounting division of Eastman Kodak Company. He also installed a budgetary control plan at the Clark Stek-O Corporation in Rochester*

## FOREWORD

Properly conceived and administered, a complete budget is of definite value to the management of any business. It is not, however, a substitute for, but rather a practical tool of, progressive management insuring good planning and replacing hindsight with foresight.

The value of a budget plan is dependent to a marked degree upon the attitude of the management of the company. Unless all the executives of the company, including the chairman of the board of directors, the president, and all the supervisory personnel, are in full accord and sympathy with the principles of budgetary control, the budget stands little chance of paying its own way.

Nothing will retard the success of such a plan any more than to have it known that only the lukewarm approval of the principal executives has been given to it. In our own experience, we have made every effort to win the confidence of every individual in the company in our aims and objectives. We believe we now have 100 per cent cooperation. This has resulted in a concerted action throughout our organization that has effected annual savings running into six figures.

A fundamental requirement in gaining this support, which we early recognized, is that every member of the executive and supervisory staffs should have an active part in the construction of the budgets covering expenditures in his portion of our organization. In this way each individual is able clearly to identify and understand the part he is expected to play in the management and progress of the company.

In our own case we have found that a better coordination of activity is assured when lines of budget responsibility are definitely fixed. There is less chance of unwise expansion as long as month-to-month results can be checked against a standard, and a proper relationship is established and maintained between income and expense.

This fundamental principle of cooperation is the basis upon which our whole budget program has been constructed. We believe that such coordination could not be obtained in any other way. This is particularly true in regard to the budgeted outlook for our company. Our plans are tied in definitely with tomorrow as well as today, and our executives look to 1940 and 1941 rather than concern themselves with what happened last year or the year before. The fast-moving pace of modern business with its broad fluctuations and general economic instability is much less bewildering to the company executives when they can see a goal ahead and work towards it. The budget represents their guide towards that goal. They use it as a convenient method of putting their finger on the pulse of the company, of being able to see the whole picture of operations compared with predetermined objectives.

P. K. POULTON

# FOR PROFIT

**"Complete" budgets give Talon executives a coordinated view of all operations, can do as much for you. Later articles by the same two authors will cover production and service department budgets, and inventory control**

**P. K. POULTON and P. H. GOLDSMITH**

*Secretary & Treasurer and Budget Director*
*Talon, Incorporated, Meadville, Pa.*

IT IS OUR FIRM BELIEF that no management can afford to pass up the installation and operation of a budgetary control system when that system is so designed as completely to encompass plans and policies for continued profits.

A complete financial budget sets forth the objectives of the management for a definite period of time.

With the complexity of modern industry, it is axiomatic that no one man can be a specialist in all the functions of running a business. Nevertheless, it is essential that the key executives of each concern have a coordinated view of *all* operations. As a result of large-scale production, there is the increasing tendency for top executives to get further removed from any close appreciation of the mechanism of the business as a whole, and in order for management to function most effectively it must be furnished with a comprehensive and complete view of all operations, as well as retain immediate and definite control over the personnel of the organization. It has been our experience that a budget system is the simplest and most effective method of achieving this result. The budget is unbiased and impersonal, but furnishes a definite interpretation of the productiveness of each department in uniform, one-dimension terms —*dollars of cost.*

Three well-defined functions are exercised by the budgetary control system now in operation at Talon:

1. *Forecasting* of future sales volume and income on the basis of consumer needs and the price levels at which such volume can be economically attained.

2. *Coordination* of all activities of the business for the attainment of the anticipated profit goal at the forecast volume.

3. *Charting the course* of management policies in view of actual monthly performance and trends in order to meet the goal previously set.

*Potential Markets*—Since the sales budget is an estimate of all income, and all operating expenses are governed accordingly, the success or failure of any budget plan in the first instance hinges upon the care and foresight with which this budget is prepared. As a preface to setting up the sales budget, our first consideration was to determine the total potential market for all types of closures on which the slide fastener could conceivably be used.

## Long-Term Planning

The survey of the potential market together with the present rate of absorption is of particular value in long-term planning. It helps us to solve our expansion problems by pointing to the industries and territories with the highest potential profits. Manufacturing and distribution facilities can be located most advantageously with reference to the market, and sales effort can be directed with increased effectiveness. The trends in the absorption of the potential market are also a determining factor in forecasting, since the growth trend in each outlet industry or application shows a distinct tendency to level off as sales approach the higher limits of absorption.

*Budgeting Sales Income*—Our sales forecasts for the coming year are built up in two ways: (1) By application (use of the fastener) in a manner similar to the process used in determining the potential market; (2) by estimates of the requirements of our key customers.

The basic forecast is made from a selected group of key manufacturers who have large-volume operations, advanced technical skill, or style leadership. These factors naturally carry more weight and are more sensitive indicators of sales trends. By dealing with this smaller number of customers, a more detailed analysis of future production requirements is a practical possibility. This is of prime importance to the factory superintendent.

In the key-customer sales budget the requirements of each manufacturer for the coming year are estimated by individual product specifications as well as in units and dollars. These estimates by specification are totaled, and trends are compared with the over-all forecast of sales by product specification. In this way we have a careful check upon the sizes, lengths, types, and colors that will be sold in the coming year.

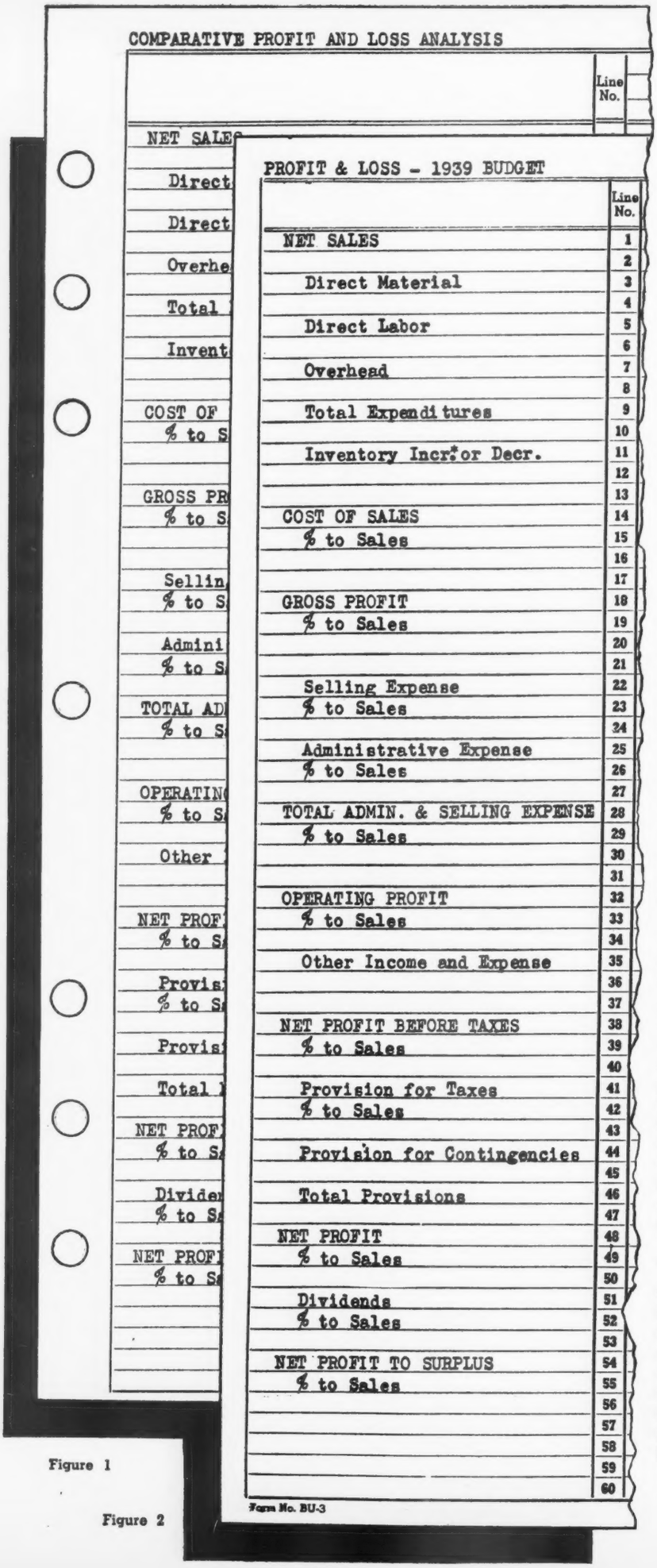
*The Profit and Loss Budget*—The master control is, of course, the profit and loss budget. If we know the anticipated sales income, the minimum profit desired, and the resultant taxes, it is evident that a limit is established beyond which selling, administrative, and manufacturing expenditures cannot go without seriously curtailing capital return.

Making use of basic information concerning past cost records, present cost trends, and anticipated cost reductions, we then break down the total expenditure into the various cost elements—selling expense, administrative expense, direct labor, direct material, factory overhead, etc.—and corresponding limits are established for each. We find a picture of the long-term trend in each of these income and expenditure elements, presented graphically in Figure 1, to be of great value in establishing these limits. Unfavorable or unusual tendencies in operating results can be discovered at once, and a preliminary control for the coming year's budget can be established prior to building up the final budget in its complete details.

## Seasonalized by Months

The direct result of this analysis is the establishment of our profit and loss budget for the coming year. This budget is seasonalized by months and presented in the form shown in Figure 2. This profit and loss budget is then supported by budgets covering each of the income and expense elements and forms the basis for the financial section of our complete budget. The profit and loss budget and the corresponding trend charts act as summaries of all operations, and furnish sharp indications of the business tendencies more promptly than any individual departmental budgets on which they are based.

This same total budgeted expenditure is then subdivided on a functional basis among the various divisions and departments comprising the company. This is



COMPARATIVE PROFIT AND LOSS ANALYSIS

| | Line No. |
|---|---|
| NET SALE | |
| Direct | |
| Direct | |
| Overhe | |
| Total | |
| Invent | |
| COST OF | |
| % to S | |
| GROSS PR | |
| % to S | |
| Sellin | |
| % to S | |
| Admini | |
| % to S | |
| TOTAL AD | |
| % to S | |
| OPERATIN | |
| % to S | |
| Other | |
| NET PROF | |
| % to S | |
| Provis | |
| % to S | |
| Provis | |
| Total | |
| NET PROF | |
| % to S | |
| Divide | |
| % to S | |
| NET PROF | |
| % to S | |

PROFIT & LOSS - 1939 BUDGET

| | Line No. |
|---|---|
| NET SALES | 1 |
| | 2 |
| Direct Material | 3 |
| | 4 |
| Direct Labor | 5 |
| | 6 |
| Overhead | 7 |
| | 8 |
| Total Expenditures | 9 |
| | 10 |
| Inventory Incr. or Decr. | 11 |
| | 12 |
| | 13 |
| COST OF SALES | 14 |
| % to Sales | 15 |
| | 16 |
| | 17 |
| GROSS PROFIT | 18 |
| % to Sales | 19 |
| | 20 |
| | 21 |
| Selling Expense | 22 |
| % to Sales | 23 |
| | 24 |
| Administrative Expense | 25 |
| % to Sales | 26 |
| | 27 |
| TOTAL ADMIN. & SELLING EXPENSE | 28 |
| % to Sales | 29 |
| | 30 |
| | 31 |
| OPERATING PROFIT | 32 |
| % to Sales | 33 |
| | 34 |
| Other Income and Expense | 35 |
| | 36 |
| | 37 |
| NET PROFIT BEFORE TAXES | 38 |
| % to Sales | 39 |
| | 40 |
| Provision for Taxes | 41 |
| % to Sales | 42 |
| | 43 |
| Provision for Contingencies | 44 |
| | 45 |
| Total Provisions | 46 |
| | 47 |
| NET PROFIT | 48 |
| % to Sales | 49 |
| | 50 |
| Dividends | 51 |
| % to Sales | 52 |
| | 53 |
| NET PROFIT TO SURPLUS | 54 |
| % to Sales | 55 |
| | 56 |
| | 57 |
| | 58 |
| | 59 |
| | 60 |

Form No. BU-3

Figure 1

Figure 2

accomplished in conjunction with the department heads and foremen who estimate what their expenditures will be for the coming year, taking into consideration the anticipated volume and type of business. Whenever it is found that these estimates exceed the limits established in the preliminary survey, we consult with the division or department heads to determine what cost reductions may be made in order to stay within the expenditure boundaries.

Because of the variation in the proportional share of the various units in the total cost, it is often found that anticipated savings in some departments may be used to permit justifiable increases in others. The concept of the sales dollar and its breakdown into its component parts (Figure 3) is found helpful in working with the operating personnel. More effective, in some cases, is the same breakdown in terms of average unit value of the product.

## Broken Down by Account

These departmental budgets are broken down by account, covering all expenditures for material, labor, and overhead for the coming year. When completed, they are summarized by plant and division in accordance with our functional organization set-up. These budgets then form the departmental section of the complete budget. When the departmental section is finished, it is tied to the financial section, and any necessary reconciliations are then made in the latter preparatory to the final draft of the profit and loss budget.

*Responsibility for Expenditures*—In order to make such control capable of immediate action when income and expense trends show an unfavorable or unforeseen change in direction, it is necessary to establish the accounting structure, including the various expense accounts, on a departmental basis according to function. Every department and account is, moreover, tied in with one individual who is not only in direct charge but is also to be held responsible for every dollar of income or expense within that particular grouping. All the plans, policies, and necessary opera-

**Figure 1. A picture of the long-term trend (1931-1938) of the various cost elements is of inestimable value in establishing necessary limits. (Items in Figure 1 partially concealed to conserve space, are exactly the same as those in Figure 2)**

**Figure 2. Direct result of analysis of long-term trends is establishment of profit and loss budget by months for the coming year**

tions of the business are coordinated in a comprehensive budget plan through the use of one common denominator—*dollars and cents.*

In other words, the aims as well as performance of all divisions of the business—even, in our own case, research and tool design—are reduced to a dollar equivalent; goals are set for definite periods of time, and the results and progress are shown at these various predetermined intervals. From a comparison of these results with the standards established, the executives are at once aware of conditions.

### Toward the Profit Goal

In short, the establishment of our budget creates a coordination of all activities in all departments of our organization looking toward the attainment of the desired profit goal. We are looking ahead in that many obstacles in the path of our achievement of that goal are recognized at the time the budget is established and steps are taken at that time to remove them.

*The Complete Tie-in*—It follows from the preceding general discussion that our complete operating budget consists of two sections:

1. The financial section, headed by the profit and loss budget together with supporting budgets covering each item on the income and expense statement.

2. The departmental section, which budgets the same total expenditure on a functional basis according to the lines of individual responsibility within our organization.

The distinction between the two sections can be readily understood by observing the relative positions of the components of our selling expense when placed on a functional basis as shown in Figure 6. In the financial section, shipping expense is treated as an element of our total selling expense, whereas in our organization the Shipping Department is included within the Factory Planning Division, and its budget is so set up in the departmental section.

Certain departmental budgets will not tie in directly with the expense chargeable to that division in the financial sec-

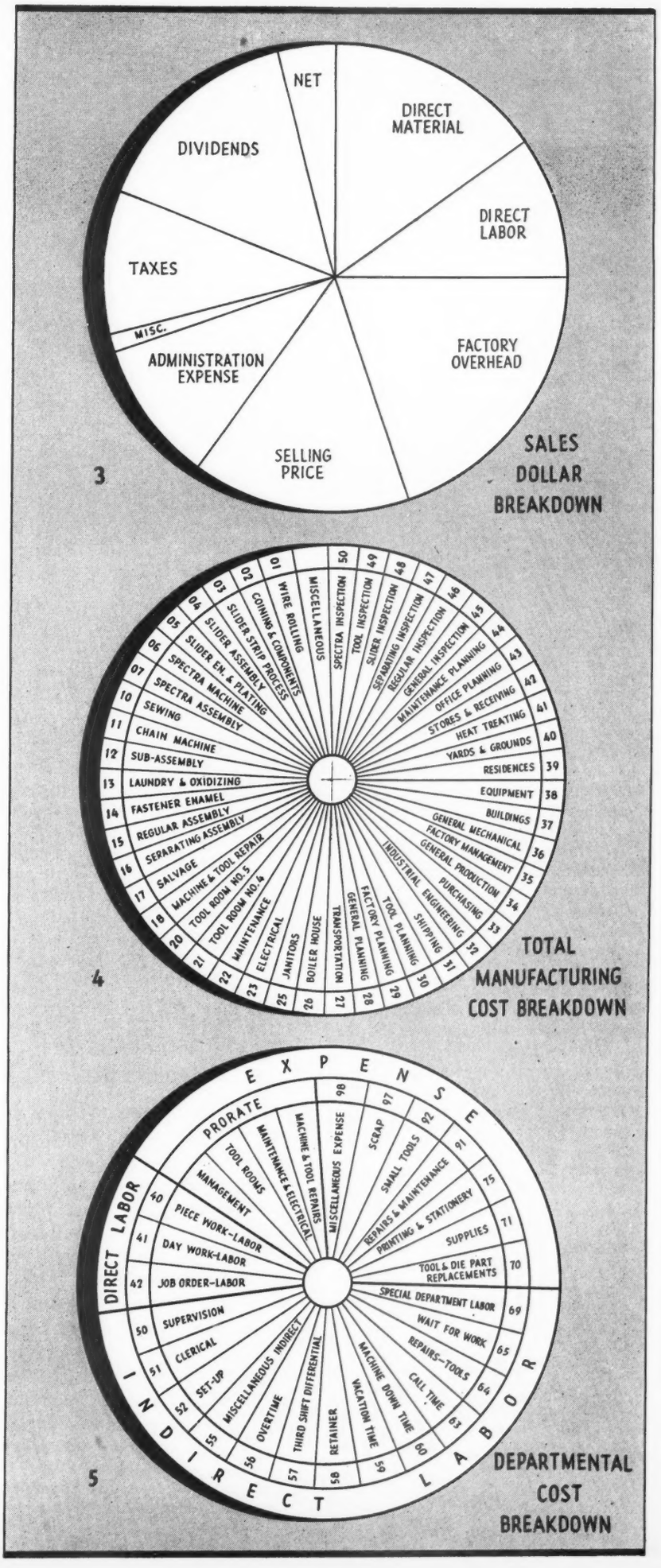



**Figure 3. Shows the major breakdown of the sales income dollar of a mythical manufacturing concern on a ratio basis Figure 4. This pie chart represents total manufacturing costs and shows what each department shares in the total expenditure Figure 5. A typical departmental total expenditure by account is broken down here as a guide to the foreman or supervisor**

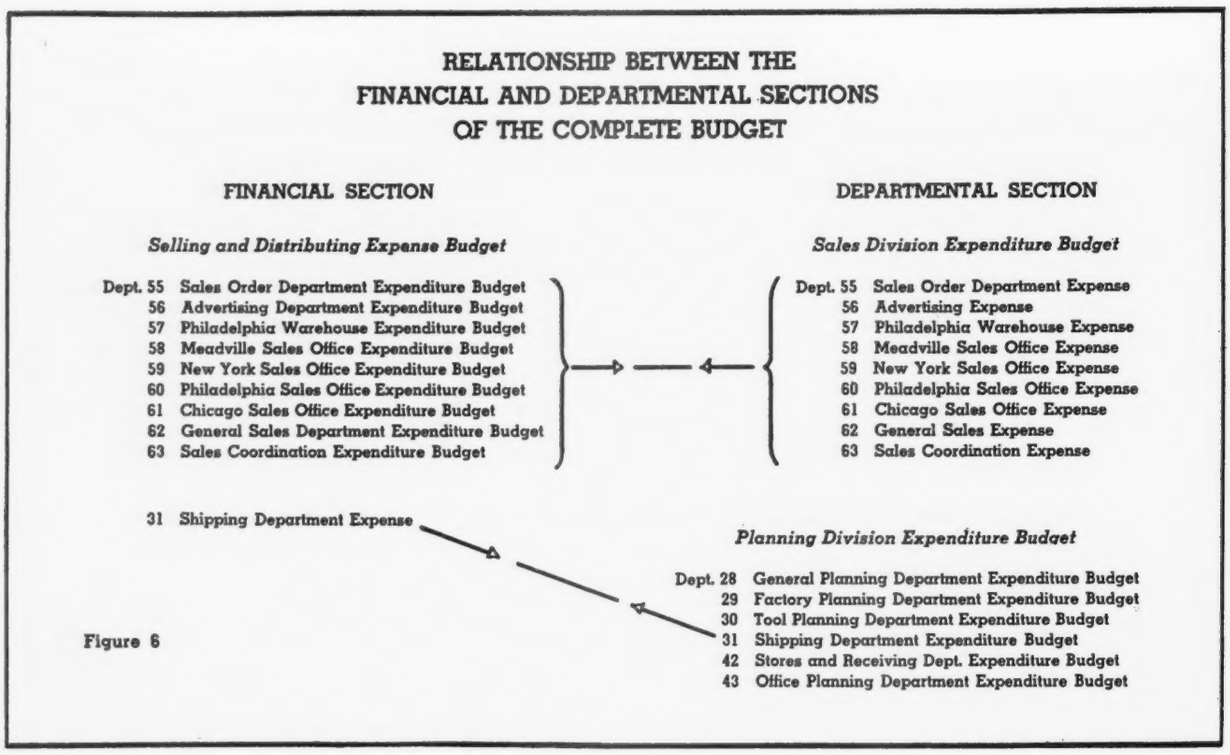

RELATIONSHIP BETWEEN THE
FINANCIAL AND DEPARTMENTAL SECTIONS
OF THE COMPLETE BUDGET
FINANCIAL SECTION
DEPARTMENTAL SECTION
Selling and Distributing Expense Budget
Dept. 55 Sales Order Department Expenditure Budget
56 Advertising Department Expenditure Budget
57 Philadelphia Warehouse Expenditure Budget
58 Meadville Sales Office Expenditure Budget
59 New York Sales Office Expenditure Budget
60 Philadelphia Sales Office Expenditure Budget
61 Chicago Sales Office Expenditure Budget
62 General Sales Department Expenditure Budget
63 Sales Coordination Expenditure Budget
Sales Division Expenditure Budget
Dept. 55 Sales Order Department Expense
56 Advertising Expense
57 Philadelphia Warehouse Expense
58 Meadville Sales Office Expense
59 New York Sales Office Expense
60 Philadelphia Sales Office Expense
61 Chicago Sales Office Expense
62 General Sales Expense
63 Sales Coordination Expense
31 Shipping Department Expense
Planning Division Expenditure Budget
Dept. 28 General Planning Department Expenditure Budget
29 Factory Planning Department Expenditure Budget
30 Tool Planning Department Expenditure Budget
31 Shipping Department Expenditure Budget
42 Stores and Receiving Dept. Expenditure Budget
43 Office Planning Department Expenditure Budget

Figure 6

tion because a portion of their budget is for capital expenditures. For example, the departmental budget for the Mechanical Division exceeds the amount of mechanical expense charged to Manufacturing Cost in the financial section. The difference, however, appears in the capital expenditure budget.

It is important to recognize that, eliminating capital expenditures, our departmental section is tied dollar for dollar to the controlling financial section, and a reconciliation is embodied in the actual expense budget records.

*The Sales Dollar Concept*—One of the basic concepts of a well-planned and comprehensive financial budget is that a definite ratio be established for each calendar or fiscal year for each expense or expenditure of the business as related to the sales income dollar. In our own operations we have followed this principle in establishing such ratios and comparing them with actual month-to-month performance.

Our sales income dollar is broken down into six primary factors: (1) Factory costs (direct material, direct labor, and overhead); (2) selling and distributing expenses; (3) administrative expenses; (4) provisions for taxes, bonus, and contingencies; (5) dividends; (6) net profit. In establishing these standard ratios of expense it is not enough simply to judge on the basis of the ratio for our particular company as compared with previous years, because the ratio might have been so poor for the previous year that the percentage of improvement would be grossly exaggerated in its importance when compared with standards for the industry as a whole.

In this connection we have found it to our advantage to consider carefully such financial ratios as reported by Dun and Bradstreet, the U. S. Bureau of Census, and others as applying to our particular type of industry. In this way we are exposed to a picture of the healthy and desirable business conditions which should obtain for our company over a period of years.

In our own work we have found the use of simple pie charts particularly effective in illustrating these ratios. The circle represents the sales income dollar and is divided according to the percentages allocated to production expenses, administrative and selling overhead, miscellaneous taxes, dividends, and net (Figure 3). The obvious point, and yet one too often overlooked, is that the sales dollar is a complete unit; it is a closed circle and cannot be stretched to cover any extraneous or unusual items except by a compensating or offsetting

(*Continued on page 120*)

+ + +

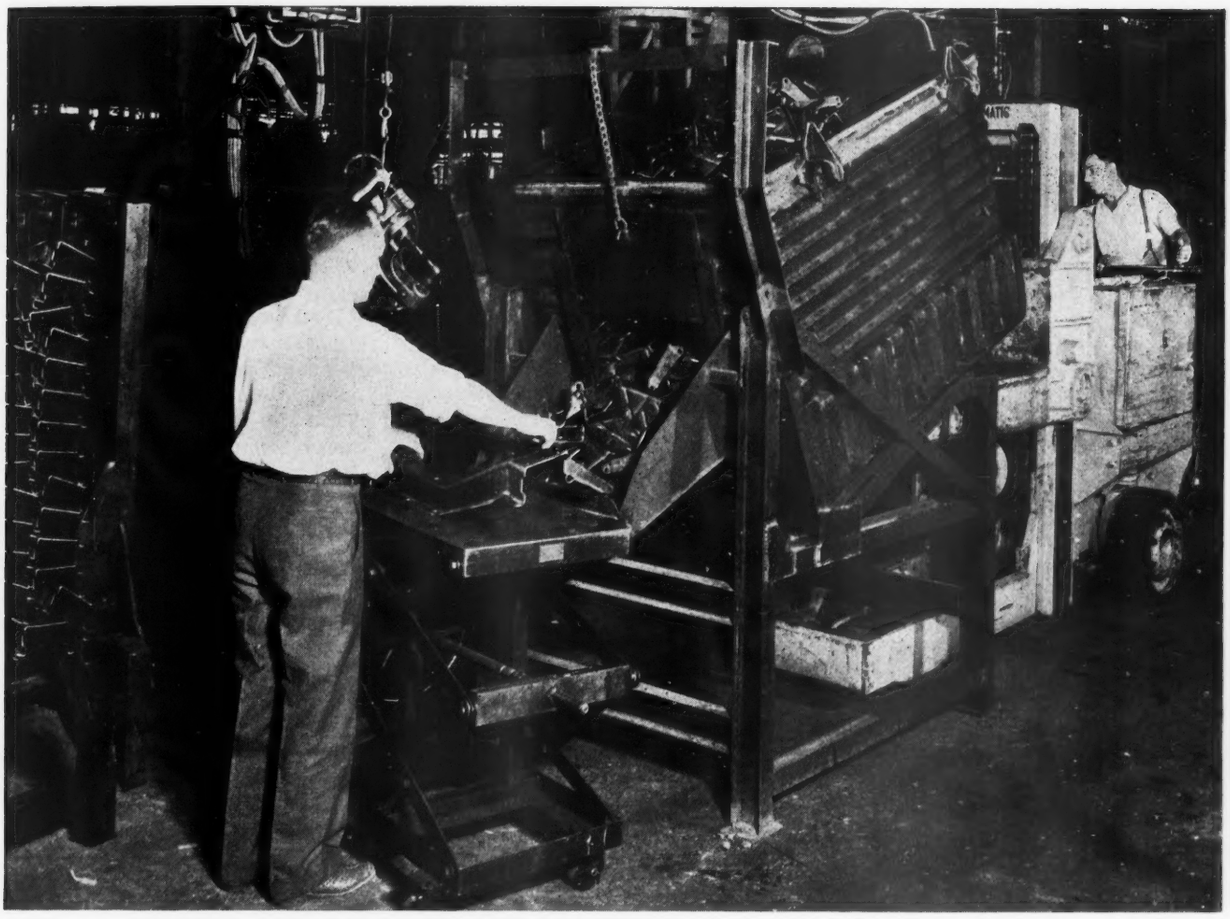
## That Gives Me an Idea

**Countless times this statement will be made by FACTORY users of the November special issue, "Quick Ways to Profits."**

**To give "ideas" is the purpose of the issue—ideas that will help cut the cost of products. To cut them by saving materials and power, by taking advantage of the greater productiveness of modern equipment, by using labor effectively.**

**And why is lower cost of production so important? Simply to permit lower sales prices for industry's products—in order to make more sales—and then to receive more orders—to create eventually more jobs, and raise the standard of living—to help industry operate at a profit.**

**Remember "Quick Ways to Profits," to be published in November. It is an issue designed to serve every plant-operating man in the manufacturing industries, because each such man is in position to help his company lower the cost of making its products**



The rack that holds the skid box is of all-welded construction and so designed that the box tilts as it slides into position. Note the chain hanging from the rack—as the skid box tilts forward, the door opens, and the heavy parts slide into working position

# Skid Box Doubles as Hopper

**Remember that small gravity-fed hopper used in light assembly work? Here is its big brother, specially adapted to handling heavy parts used in automobile bodies**


**E. I. BeMENT**

*Assistant Manager, Standards Division*
*Murray Corporation, Detroit*


HERE IS A SKID BOX that is quickly transformed into a gravity-fed hopper by setting it in position on a specially constructed rack.

All motion study enthusiasts are doubtless familiar with the small bins and hoppers designed for use in light assembly work. Many types have been constructed; some of them have been shown in FACTORY'S pages. Most of them have been confined to small applications, however, whereas here the same principle has been applied to the handling of large body and frame parts used in the manufacture of automobile bodies.

The photograph tells most of the story. In the background is the high-lift truck that does the heavy hauling and lifting part of the job. The skid box differs from the garden variety in that it has a sliding door.

The rack is an all-welded affair constructed in our own shop. It has a stout chain attached to the top front crossbar. And note the hopper which is an integral part of the rack.

Now the idea in operation is simplicity itself. Along comes the lift truck with a skid box full of parts. It raises the box into position. The ring on the end of the chain is slipped over a hook on the box door, and as the lift truck lowers away the skid box is tilted into position, the door opens, and the parts slide into the hopper. There they are in convenient position for the operator at the point of use.

# Controlling Work in Process

**Part 2. Wherein the authors get right down to a brass tacks application of the basic principles of work-in-process control, which they outlined in Part 1 (July)**

J. J. COLBERT and B. A. MOSKI, JR.
*Industrial Engineers*

PRACTICAL APPLICATION of the principles of work-in-process control, described last month, is accomplished by providing mechanics of control based on those principles. These mechanics include design of the necessary paperwork and provision for its proper usage, special plant layout provisions, and the designation of duties and responsibilities to those who exercise the control.

A specific case of controlling work in process will be described in this article. It is that of a typical project—involving considerable engineering, substantial raw material purchases, manufacture of component parts, subassemblies, and final assembly.

Perhaps before taking up detailed consideration of this control technique, a brief outline of ordinary procedure and paperwork will help us to appreciate the recommendations that follow.

Each manufacturing department usually has an outgoing bay or shipping section to which all parts produced in the department are moved, and where a delivery ticket is made out in triplicate.

One copy of the delivery ticket stays with the material, and is removed and filed when the material reaches its destination. It serves as the record for receipt of materials, and in most cases is not verified by a physical check. The second copy is placed in the files of the shipping section, as verification of the shipment. The third copy goes to the accounting department, for entry in the work-in-process account.

In both the department shipping the material and the department receiving it, the delivery tickets are posted against the material list of the product being manufactured. When the postings to the list indicate that sufficient component parts are available, assembly operations begin.

For products involving many subassemblies the volume of paperwork is considerable. The exchange of delivery tickets for every move of materials requires many clerical operations and increases the probability of error.

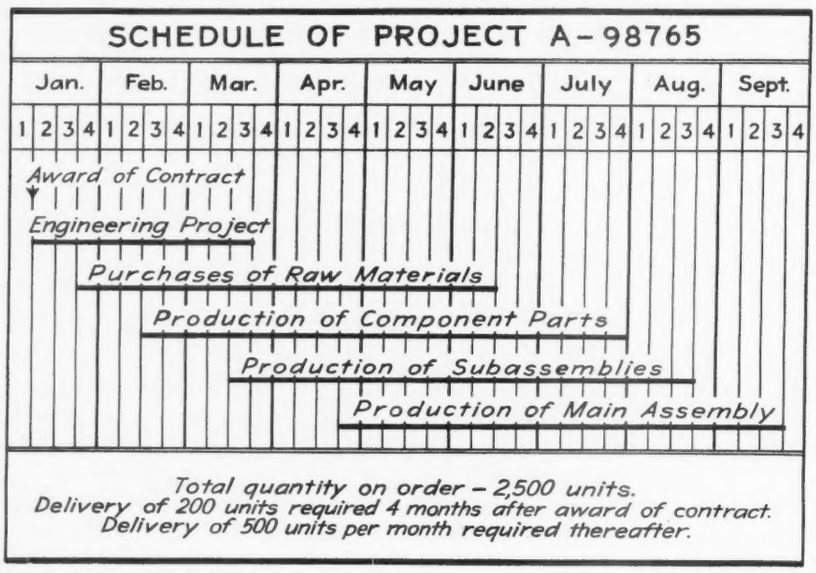

SCHEDULE OF PROJECT A-98765
Jan.
Feb.
Mar.
Apr.
May
June
July
Aug.
Sept.
1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4
Award of Contract
Engineering Project
Purchases of Raw Materials
Production of Component Parts
Production of Subassemblies
Production of Main Assembly
Total quantity on order – 2,500 units.
Delivery of 200 units required 4 months after award of contract.
Delivery of 500 units per month required thereafter.

**Figure 1. The master schedule is the starting point for controlling work in process. It shows when contract was awarded, delivery promises, key dates that must be kept**

For purposes of work-in-process control, delivery tickets are of little value. The file of slips is usually consulted only when shortages occur, which is simply *post-mortem* work.

This common routine of paperwork does not serve to reduce the cost of repeat orders. The same procedure must be carried out again and again, even for identical orders.

Proper control of work-in-process must be related definitely to the master production schedule. Unless key dates for the beginning and completion of major operations are determined in advance, subsequent efforts to control are unduly costly. The goal must be established before it can be attained.

### Key Dates Are Specified

The master schedule for the project whose progress we want to follow appears in Figure 1. The order calls for 2,500 units, with a delivery of 200 units required four months after award of the contract, and a delivery of 500 units per month thereafter. Key dates are specified, starting with the award of the contract, for the beginning and completion of the engineering work required, purchases of raw materials, production of component parts, subassemblies, and the main assembly.

Such a project schedule originates with the production office, where the order has been analyzed to determine its delivery and material requirements. Sufficient intervals must be allowed between the starting dates of the various operations to insure meeting the schedule, the intervals being determined by the characteristics of the product and the past experience of the plant. All subsequent schedules must adhere to the key dates in the master schedule.

Working from the master schedule, the production office issues to the cumulation point—the area where parts are accumulated and stored preparatory to assembly—a production schedule which indicates on one chart a complete list of all materials entering a particular unit, the routing of these materials through the plant, and the scheduled dates for all subassemblies and the final assembly. Figure 2 illustrates the control chart originated by the production department for the particular project under consideration.

Although only part numbers are indicated in the "Part and Description" column of the material list on the con-

trol chart shown, the numbers should be supplemented in actual practice by brief verbal descriptions, for ready identification by persons using the chart. The symbol "A" opposite certain parts indicates a subassembly, while the part number of the final assembly corresponds with the main drawing number of the unit being manufactured.

Under "Route," the headings "From," "Work," and "To" refer to the departments from which the parts are to be drawn, where operations are to be performed, and where parts are to be sent for subsequent assembly.

The information in the "Route" columns shows the relation of all materials to each other. It will be noted that all parts required for the first subassembly are drawn from raw material stores. For the second and third subassemblies, parts are also drawn from other departments. The fourth subassembly consists of the first and second subassemblies, as well as other parts drawn from raw material stores and other departments. The final assembly is composed of the third and fourth subassemblies, together with parts drawn from raw material stores and one other department.

Under "Quantity per Unit" is entered the number of individual parts required for each unit of product. The total number of parts in the entire order is then the product of the individual numbers times 2,500.

On the control chart a section is given over to subassembly schedules. The schedule starts with a date two weeks prior to the initial production of subassemblies, as already scheduled on the master schedule, and ends with the date on which the order is scheduled for completion, or shortly thereafter. At both top and bottom of the chart there is a numerical scale running from 0 to 2,500, against which will be plotted all receipts of component parts and production of subassemblies and the final assembly. For each subassembly and the final assembly, a line is drawn to indicate the intervals during which those assemblies are to be in process. As these intervals may vary considerably for each assembly, they are all drawn to individual scales independent of the numerical scale at the top and bottom. To aid in checking scheduled requirements at any given date, divisions of the schedule lines are indicated at intervals of 500 parts.

Design of the control chart is one matter; its use as a tool of management is another. After the chart has been issued, what purpose does it serve? How does it apply the principles of work-in-process control?

In the first place, the control chart provides the personnel of the cumulation point with a clean-cut picture of the entire project. All the materials are described—where they originate, where they are to be processed, where they are to be assembled, and what quantities are needed. After brief study of the chart anyone can comprehend the job without the need for exhaustive blueprint analyses, instructions, and sundry paperwork.

Second, it provides a single sheet for recording all movements of materials, their receipt and assembly. As deliveries of materials are made at the cumulation point, quantities are spot-checked and then recorded on the control chart. As component parts are converted into subassemblies, production is also recorded on the chart. At all times the control chart serves as a perpetual inventory of materials for the project.

The graphic nature of the control chart serves yet another purpose—to point out weak spots in material deliveries before it is too late. Wherever a lag occurs, the chart is flagged to bring action long before the final assembly is due. Schedules are thus maintained through one specific control point.

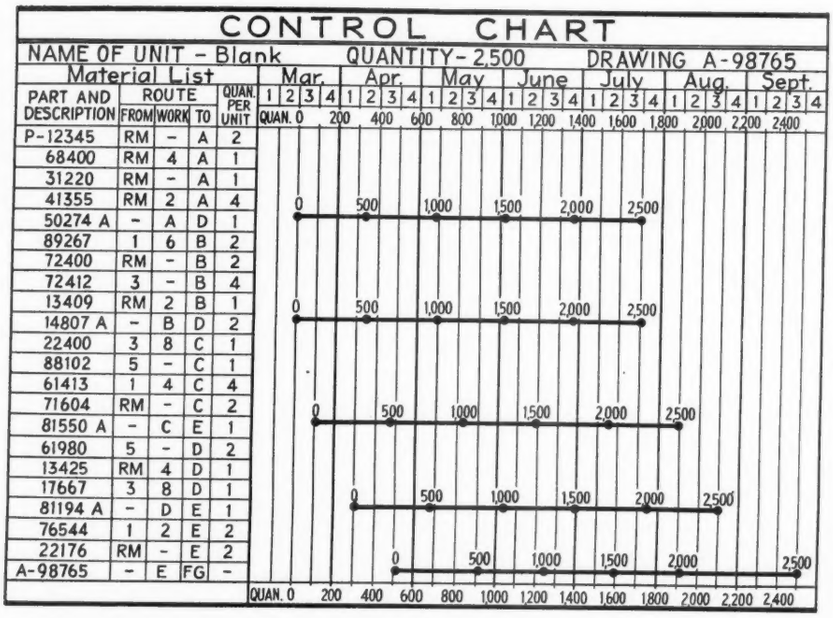



**Figure 2. Production department prepares the control chart which it passes to the cumulation point. This chart contains material list, routing, and schedule of dates for beginning and completing assemblies. *RM represents* raw material stores: *FG,* finished goods stores; odd numbers in the routing column, departments from which materials are to be drawn; even numbers, machining or finishing departments; letters, assembly departments**

## Less Paperwork

Elimination of considerable paperwork also results from use of the control chart. In small plants, where all activities are concentrated on one floor, the chart is the only record necessary for controlling work-in-process. In decentralized divisions of large plants, where certain departments produce both the component parts and subassemblies, the movement of materials clears without any additional paperwork. For accounting purposes, ordinary paperwork is still necessary for movement of materials from one department to another—but only for those interdepartmental transfers.

Substantial savings in clerical effort are secured on repeat orders as a result of the control chart. As new orders are obtained for the same product, it is simply necessary to retype the material list and routing information on another chart form, saving considerable routine order analysis. Where the quantities of repeat orders are identical, scheduling information may also be duplicated.

In summary, the control chart affords the following benefits:

1. Comprehensive picture of entire project.

2. Perpetual inventory of materials.

3. Visual control of weak points in deliveries.

4. Elimination of excess paperwork.

5. Savings in clerical effort on repeat orders.

Throughout the progress of the order, the control chart is kept up to date by the personnel of the cumulation

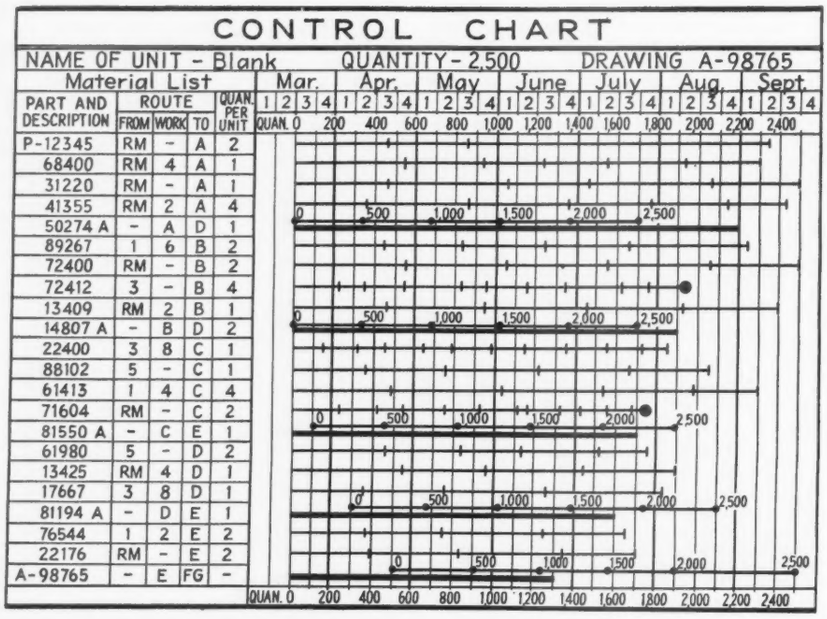



**Figure 3. Control chart as maintained at the cumulation point. As it appears, it represents condition of the order at the end of June. Light horizontal lines opposite the parts numbers indicate parts finished, while the heavy lines show assemblies completed. Deliveries of parts to the cumulation point have been represented by the small vertical marks, whereas the two parts behind schedule have been flagged by thumbtacks**

NAME OF UNIT - Blank DRAWING A-98765

Subassembly P-81550

Quantity per Set - 100

| Part | Quantity per Unit | Accumulated | Shortage |
|---|---|---|---|
| P-22400 | 1 | 100 | - |
| 88102 | 1 | 100 | - |
| 61413 | 4 | 350 | 50 |
| 71604 | 2 | 200 | - |

**Figure 4. Accompanying each set of 100 parts is an accumulation sheet which shows accumulations of the particular part and other parts going into the same subassembly. Shortages must be investigated immediately by the expediter, and corrective action taken**

point. Figure 3 shows what information is added as the order progresses.

The receipt of all materials at the cumulation point is immediately recorded on the control chart. The actual quantity of any given component part is divided by the "quantity per unit" so that the figure recorded may relate directly to the potential number of complete units of product. All quantities start at the zero point of the numerical scale, with notches in the horizontal lines representing specific deliveries.

As stated in Part I, quantities of component parts should be broken down into multiples of the schedule, and delivered intact to the assembly floor. In this case, sets of 100 have been established as convenient multiples of the order. When the control chart indicates that sufficient component parts are available for steady deliveries of sets of 100, then and then only are orders issued for assembly lines to start.

Each order of 100 component parts for a subassembly or final assembly is accompanied by an accumulation sheet, illustrated in Figure 4. Should shortages of any particular material exist, a carbon copy of this sheet is placed on the desk of the expediter specializing in that part, who investigates at once.

As each set of component parts is delivered to the assembly lines, a corresponding quantity of complete subassemblies or final assemblies is returned to the cumulation point. The quantities of these assemblies are also recorded on the control chart. Regardless of the original schedule dates of the various assemblies, the same zero point is used in recording their progress as in the case of component parts. At all times, therefore, all recorded lines relate directly to the main numerical scale at top and bottom of chart.

The control chart of Figure 3 represents the conditions existing at a specific point in the schedule—the end of the fourth period in June. For that date, the original schedule called for 1,250 completed units of the final assembly. The heavy bar of actual production indicates 1,300 assembled units. Apparently there is no difficulty in meeting the schedule for completed units.

But a further study of the control chart shows the facts indicated in the table of shortages. The first subassembly is progressing smoothly. All the necessary component parts are drawn from raw material stores, and the deliveries are excellent. The wide spacing of notches in the horizontal lines indicates that requisitions for substantial quantities are filled without difficulty.

## Here Comes Trouble

Trouble is readily visible with the second subassembly. It is already 150 behind schedule. Closer analysis reveals that ample quantities of all component parts are available, except P-72412. This part is drawn from Department 2, which is evidently overloaded. Irregular and closely spaced notches point to delivery problems at this department. The weak spot is flagged with a thumbtack, so that corrective action can be taken before the final assembly schedule is disturbed.

At the third subassembly, another snag is evident. Part P-71604 is holding up production seriously. As it is drawn from raw material stores, the difficulty apparently arises from poor deliveries by the outside supplier. Perhaps a second source of this material should be contacted. Here again, a visible danger signal is attached to the control chart.

Incidentally, a second weakness can be observed in the third subassembly, part P-22400. This part originates at Department 3, to which attention has already been drawn. The action which is being taken should apply to both of the materials in question.

At the fourth subassembly there is

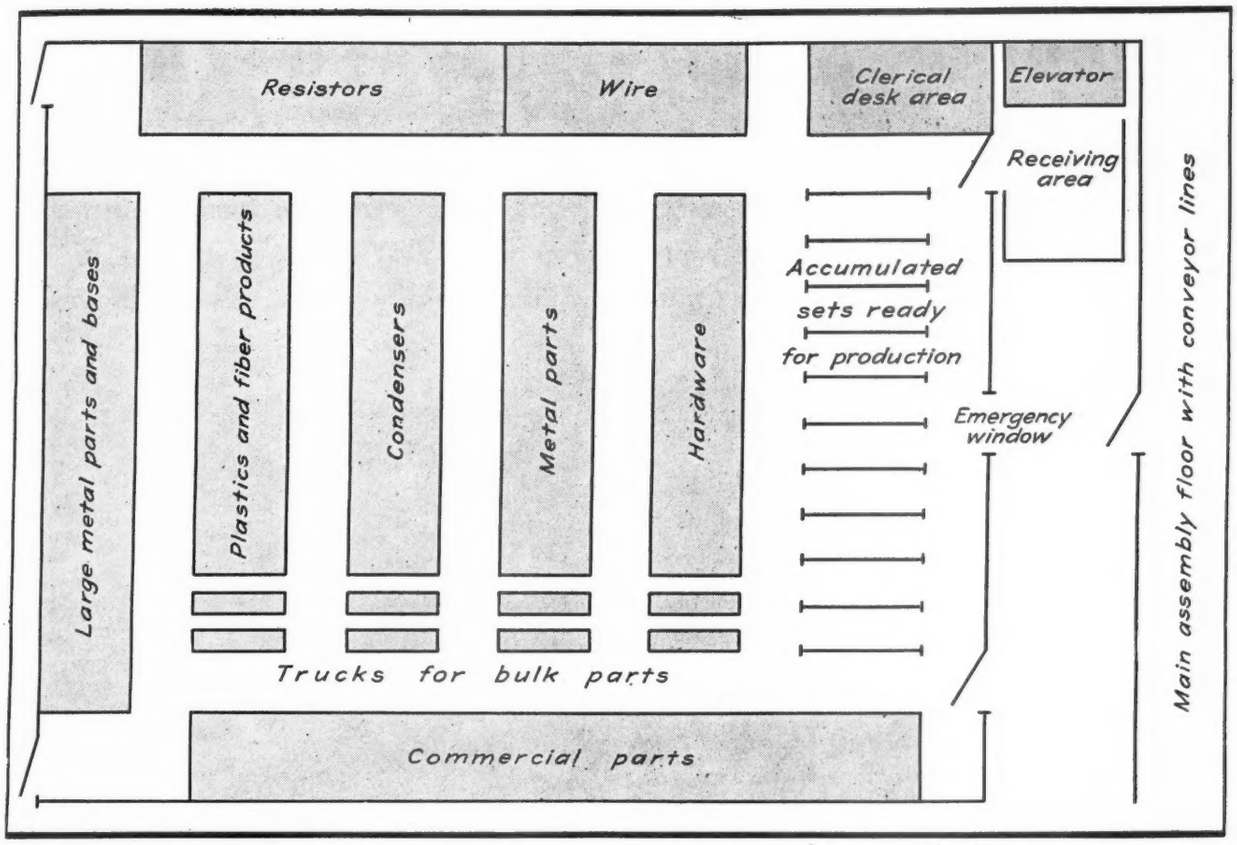



**Figure 5. A typical cumulation point—the stockroom for an electrical manufacturer's assembly lines is laid out by types of parts**

a slightly favorable margin, with 80 subassemblies ahead of schedule. But one of the parts required in this assembly is the second subassembly, which is running behind schedule. According to the final schedule dates, there should be a four-week interval between the second and fourth subassemblies, but the current interval is only three weeks. Unless the danger point in the second subassembly is corrected, there will soon be trouble at the fourth.

The final assembly has already been discussed. Before we studied the control chart, it seemed that the schedule was being met without difficulty. It is now evident that definite weaknesses must be eliminated to insure delivery of the complete order at the promised date. The control chart has served a purpose in maintaining schedules to date, but its warnings must be heeded.

The cumulation points mentioned so often are one of the most important factors in controlling work in process, for it is at these points that actual control is exercised. In many cases a single major stockroom may be sufficient to serve the entire factory. In larger plants a cumulation point may be necessary at each large subassembly department.

Proper layout of the cumulation points is of prime importance. The following factors should be taken into consideration:

1. Physical separation from the assembly floor proper.

2. Sufficient space for all materials required for normal schedules.

3. Division into sections assigned to similar classes of material.

4. Design of racks, bins, and containers to fit the types of material.

5. Sufficient aisle space to permit rapid service without congestion.

6. Temporary storage space for accumulated parts ready for production.

7. Provisions for clerical records and the control chart.

Figure 5 is a layout of a typical cumulation point. The illustration has been taken from actual practice, representing the main stockroom for the assembly lines of a nationally known concern manufacturing a variety of electrical products.

The flow of materials originates at the elevator. Immediately outside the cumulation point is the receiving area, where deliveries are spot-checked for quantities. After verification, the materials move into the cumulation point, and quantities are posted on the control chart by the clerk at the desk.

Each class of material is taken over by a stock man who specializes in that class, and who is responsible for one section of the cumulation point. In this installation, one man is assigned to wire products and resistors only. A second specialist handles hardware and metal parts, while a third takes care of condensers, plastics, and fiber products. A fourth man is responsible

*(Continued on page 130)*

**Table of Shortages**

| *Assembly* | *Scheduled* | *Actual* | *Shortage* | *Ahead* |
|---|---|---|---|---|
| P-50274 | 2,050 | 2,200 | . . . | 150 |
| P-14807 | 2,050 | 1,900 | 150 | . . . |
| P-81550 | 1,820 | 1,700 | 120 | . . . |
| P-81194 | 1,520 | 1,600 | . . . | 80 |
| A-98765 | 1,250 | 1,300 | . . . | 50 |

# Teaching Supervisors To Think

**ALLEN D. GUTCHESS**
*President, The DeVilbiss Company*
*Toledo*

**What a man thinks, determines what he does. Home-made training program teaches DeVilbiss supervisors to be leaders who know men as well as materials and methods**

**Allen D. Gutchess was elevated to the DeVilbiss presidency in that famous year when general business hit the toboggan. He started with the organization 31 years ago as a printer, took time out to go off to college, but used to come back weekends to help work up the company payroll. For 14 years prior to taking on his present job, he was secretary to Mr. DeVilbiss, the founder of the business**

WHEN OUR MANAGEMENT came to the conclusion that general or specialized training offered to supervisors in the YMCA, business, and evening schools was not sufficient, we outlined a training program of our own. We planned a group of discussions around our own problems, for those were the nuts our supervisors had to crack and for which they most needed preparation.

Realizing the truth in the old saw, "What a man really thinks determines what he does," the discussions were built around getting the supervisor to thinking in the right channels. These right channels were not what someone else had set up as a standard or written in a book, but what our men as a group decided was right. Management recognizes the importance the supervisor plays in working out industry's problems. Higher standards are being set up for all supervisory jobs—more than mere manipulative skill and knowledge of production methods is necessary to hold them. The supervisor must be a leader who knows not only materials, machines, and methods, but also men.

A supervisor's duties consist largely in organizing the thinking of his men. On this theory all supervisors have a part to play. The set-up men and assistant foremen really get closer to the operators than the foremen do, for they assign the work and show how it should be done. The time-study department, too, comes into frequent contact with the operators and has a great deal to do with affecting the employees' attitude; therefore time-study men should have the same course of training as foremen.

### For Better Human Relations

Key inspectors were included in our program for much the same reason, but with the additional consideration that better human relations between production and inspection were desirable. In this latter case, of course, the thought was that there is not only a relationship problem between supervisor and operator, but also a cooperative problem among the supervisors themselves. Incidentally, the same idea is utilized in a series of conferences between sales and engineering, to get them working together and speaking the same language.

Our program, it should be stressed, is a home-made product, expressed in shop terms and devoted to our own local problems. We were advised, and admonished, not to include all the functional groups mentioned above in one class or conference. Yet that is just what has been done, contrary to what seems to be generally accepted practice.

The belief that set-up men and subforemen would not express themselves freely in the presence of foremen and superintendents is not substantiated by our experience. Perhaps it depends upon the skill of the conference leader; at any rate, anything we told the foremen, or discussed with them, we wanted also to tell or discuss with the assistants and set-up men. Company policies regarding human relations are thus expressed but once and alike to all who have to put them into effect, and likelihood of misinterpretation through repetition is minimized.

However, to keep the size of the conference groups to manageable proportions, the number of members was limited to 25, which meant that Paint Spray, Atomizer, and Compressor Divisions met on different days; but there was no split on the basis of rank.

A committee, whose membership represents the various divisions of the business directs the training program. The superintendent, chief inspector, personnel director, time-study supervisor, and two general foremen constitute this committee. But direction is not

## Analysis of Scrap and Repairs, Causes and Remedies

| Causes | Method of Reducing or Eliminating the Causes | Whose Responsibility it is to Correct Condition. |
|---|---|---|
| 1. Insufficient and improper instruction. | Understanding on the part of every supervisor on "How to Instruct". | Management.<br>General Foreman.<br>Foreman. Set-up Man. |
| 2. Improper use of tools, fixtures and equipment. | Training.<br>Instruction.<br>Supervision | Foreman and Set-up Man. |
| 3. Improper inspection. | Set-up proper inspection procedure.<br>Furnish sufficient and proper gauges.<br>Provide proper, workable tolerances. | Inspection Dept. Foreman, Set-up Man.<br>Inspection Dept. Management.<br>Engineering Dept. |
| 4. The wrong man on the job. | Supply proper information about the requirements of the job to the personnel department. | Foreman.<br>Set-up Man.<br>Personal Manager. |
| 5. Misunderstanding of employee's duties and responsibilities. | Proper and sufficient instruction. | Foreman.<br>Set-up Man. |
| 6. Lack of co-operation between individuals and depts. | Reason with employees.<br>Develop confidence.<br>Know yourself.<br>Listen to constructive suggestions. | Management.<br>Foreman.<br>Set-up Man.<br>Time Study Dept.<br>Inspection Dept. |
| 7. Lack of good housekeeping and safety measures. | Keep your place clean.<br>Use safety devices furnished and find use for more. | Entire Personnel. |
| 8. Lack of job analysis. | Think your job, suggest improvements.<br>Learn how to make job analysis. | Foreman.<br>Set-up Man.<br>Operator. |
| 9. Incorrect materials. | Proper specifications.<br>Proper Inspection. | Engineering Dept.<br>Purchasing Dept.<br>Inspection Dept. |
| 10. Improper handling of materials. | Provide necessary and sufficient equipment.<br>Proper instruction.<br>Allow sufficient time.<br>Proper supervision.<br>Co-operation between departments. | Management.<br>Foreman and Set-up Man.<br>Time Study Dept.<br>Foreman and Set-up Man.<br>Foreman. |

**Points brought out in group discussions were published to provide supervisors with a handy checklist. This page and the following one cover twenty-two reasons for scrap**

its sole duty. Foremen conferences run through the winter for 15 weeks, but this policy committee meets monthly throughout the year to consider operating problems. Since it is our belief that most operating problems are grounded in human relations, this committee's attention is pretty largely cast in that direction.

The question constantly before the committee is: "What can we do to help our foreman help his workers?" Diversity of the DeVilbiss line, coupled with a policy of manufacturing parts to stock during slack sales periods, results in a fairly constant working force, with the result that a large number of our 700 productive operators are known personally, by name, to management. The members of this committee spend a great amount of time in the shop talking with foremen and operators. This enables the committee to get the feel of the workers' attitudes and ways of thinking about current situations.

I suspect that a big question mark has immediately arisen in the mind of some readers after this last statement. "But are you not undermining the foreman in his own department?" they will ask. No, foremen conferences have instilled the idea that we are all together in this human relations problem, all working in the same direction. If some maladjustment is discovered in these talks with employees, the foreman is approached with the attitude: "Let's get our heads together on this." At the same time the committee is able to point the foremen conferences in the direction that will give immediate assistance in daily work.

### Notes for Everyone

As mentioned before, the program is a home product. No prepared lessons are used, but the conference leader, a member of the state vocational education division, gets together with the committee, and the points to be covered and stressed are outlined before each meeting. These points are then drawn out and elaborated at the meetings by liberal use of the blackboard. The committee secretary prepares extensive notes which are typed and given to all members of the group as a permanent file of the principles and policies that have been developed.

When we began this program the mechanics of the supervisor's job were first brought out by examining the factors influencing quality of the product. Scrap and waste, with causes and effects on costs, formed a part of this subject. Considered also were methods of instructing operators, care and use of tools, inspection, placement of workers, safety, and handling of materials.

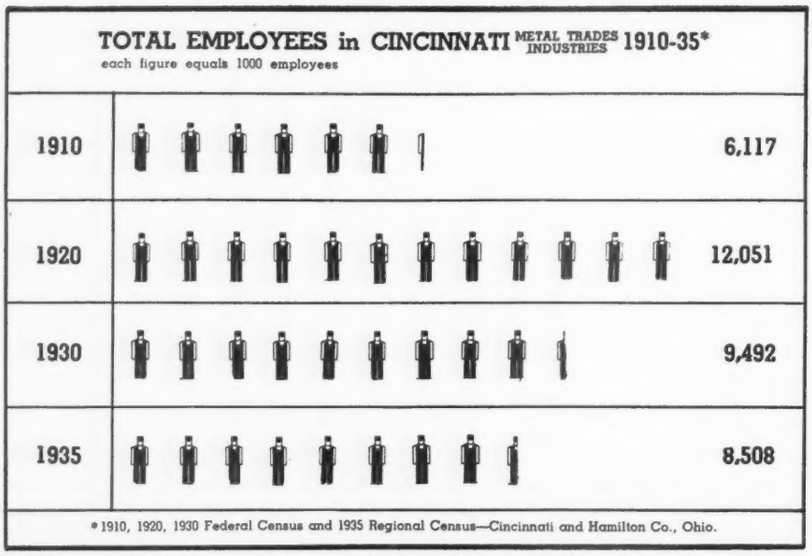
Flavor was given to this series by relating it directly to the human relations involved. Two sessions, for example, were devoted to the employee's responsibilities, in which it was pointed out that production of quality work depended largely upon having the worker properly fitted to the job, correctly instructed, and mentally at ease. Bringing about these conditions is part of the supervisor's responsibility.

Results of these meetings were published in such a way that they would serve in the future as a check list, and hence a constant reminder for the supervisors. The analysis of scrap causes and remedies shown herewith illustrates how points brought out in each meeting were permanently recorded.

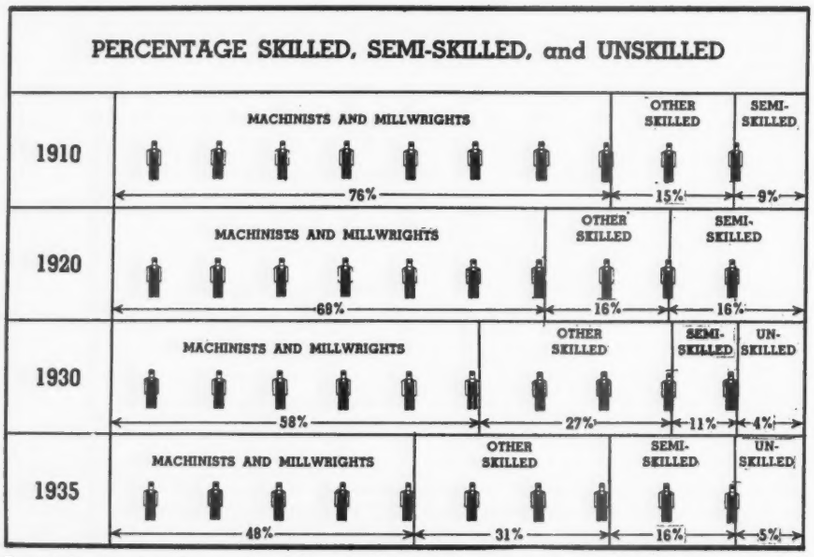
After biting into the human relations angle as it applied to quality, we decided to go a bit further into the subject by devoting the next series exclusively to it. At the start, this preface was given

*(Continued on page 124)*

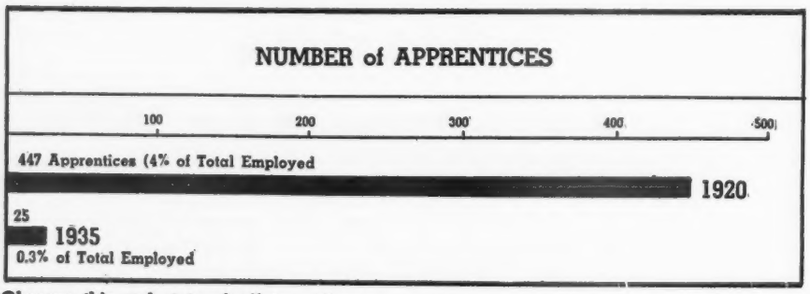
# Cincinnati Gets the Facts




**The charts tell the story. In this one, for example, we see how the total number of employees in the metal trades rose to a high of 12,051 in 1920, is now on the decline**




**Any estimate of replacement needs must take into account the changing percentages of skilled, semi-skilled, and unskilled workers. Just see what's going on in Cincinnati**




**Observe this sad state of affairs. However, a recent survey by *Factory* and *American Machinist* makes it clear that Cincinnati is definitely doing something to remedy it**

INDUSTRY'S SKILLED LABOR SUPPLY is more than ever a matter of concern. Some clue to the potential, if not actual, national shortage is presented in an unusual study of employment in the metal trades industries of Cincinnati from 1910 to 1935. This study is based on statistics gathered by Lorin A. Thompson, Jr., director of the Cincinnati Regional Department of Economic Security.

If Cincinnati's case may be taken as typical, then the metal trades industries as a whole, these figures show, had by 1935 virtually abandoned the custom of training apprentices for skilled jobs. In 1920, the federal census reported 447 apprentices at work in the Ohio city's metal- working plants—more than enough to provide needed replacements. Thereafter the apprentice system dwindled almost to nothing. No 1930 figures are available. But apprentices were counted in the 1935 regional census *and only 25 were found.*

Meanwhile the estimated annual replacement rate has risen steadily. These rates are, admittedly, theoretical and are based primarily on an analysis of life expectancy. The total number of replacements needed to provide the same labor force 20 years after a given date is divided by 20, and the annual rate is thus determined.

### Looking Ahead 20 Years

"We are very well aware that the demand for workers in any occupation or industry 20 years from now may be quite different from the present need," says Mr. Thompson in commenting on this phase of the study. "The justification for this technique, however, lies in the fact that if one projects the present need 20 years hence, it furnishes a *measure* for the training institutions and industries to consider each year."

Some significant changes have indeed taken place within the industry in recent years, the study reveals. Total employment has declined steadily from a 1920 peak of 12,051 to 9,462 in 1930, and to 8,508 in 1935. The percentage of skilled men required has also fallen. Within their ranks, there has been an interesting realignment in the demands for certain types of skill. For example, machinists and millwrights comprised 75.73 per cent of the total in 1910, 67.24 per cent in 1920, 56.58 per cent in 1930, and only 47.77 per cent in 1935. There were some shifts in the proportion of other skilled workers. But much of the shrink-

# on Training Needs

**Survey of skilled labor in metal trades emphasizes need for individual companies to know where they stand now, if they don't want to get caught short in the next boom**

age in the number of machinists and millwrights is due to the fact that semi-skilled workers had increased by 1935 to 16.45 per cent, while unskilled workers constituted 4.76 per cent.

Were it not for the decline in total employment and in the demand for craftsmen, it is likely that the metal trades industries of Cincinnati would even now be gripped by a shortage of skilled help. Instead, considerable unemployment is indicated by the 1937 special census.

### 40% Are 45 or Over

Even so, the average age of the metal trades workers is substantially above the Cincinnati industrial average. Thirty-nine and nine-tenths per cent of them were 45 or more years old, according to the 1935 regional count, compared with 33.5 per cent of employees in all other Cincinnati industries and 31.7 per cent of employees in all the manufacturing and mechanical industries of Ohio (1930 census).

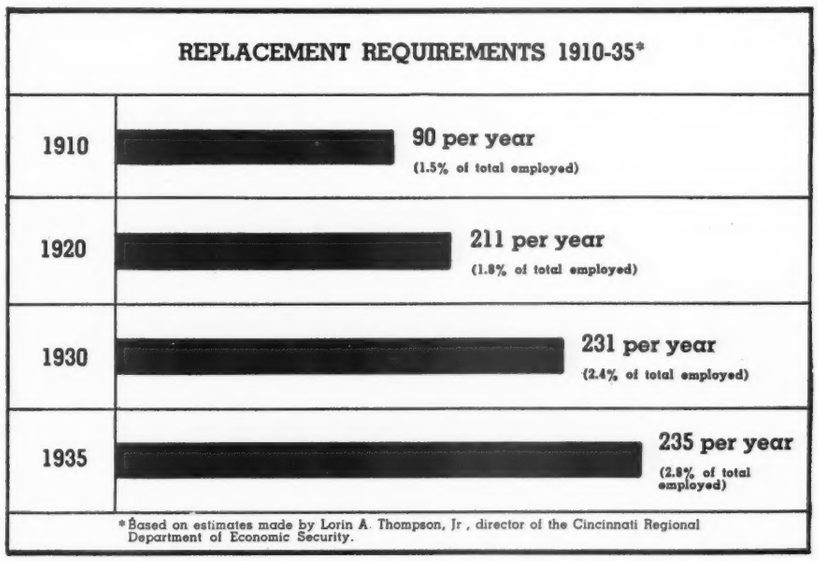
Nor can the continued increase in the estimated annual replacement rates be ignored. In 1910 the rate was set at 90 per year (1.5 per cent of the total employed). In 1920, it was 211 (1.8 per cent of the total); in 1930, 231 (2.4 per cent) and in 1935, 235 (2.8 per cent). The ratio of the replacement rate to the total employed may thus be seen to have almost doubled since 1910.

If total employment in the city's metal-working plants and the proportion of skilled men required within the industry continues to decline, then the lack of apprentices, the rising replacement rates, and even the advancing age of the employees, may not be matters of great concern. But a sudden period of exceptional activity would reabsorb the unemployed, hold many older workers at their tasks past retirement age, and emphasize the need for an apprentice system long neglected. In short, *a boom would bring about a skilled labor shortage, reduced efficiency in the industry, and a serious lag in production.*

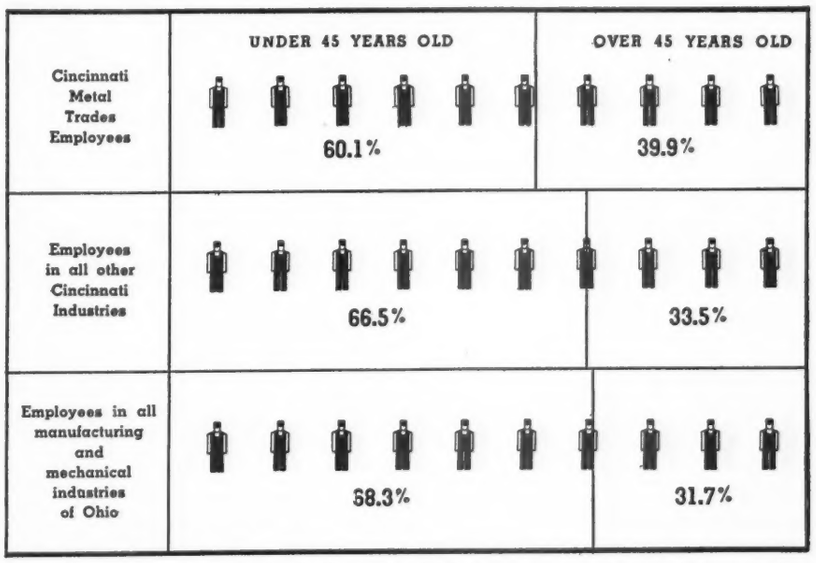
There is some ground for supposing that if total employment and the demand for craftsmen simply decline no further, the needs of the near future may produce a shortage. This might have been predicted with certainty, on the basis of the 1935 regional census, were it not for the unemployment which the 1937 census revealed. This showed 309 men totally unemployed and 268 only partly employed in the city's metal trades plants.

This number is not so formidable, however, when certain factors are taken into account. Assume that the unemployed are divided, as to trade and age, in about the same proportions as the employed. Then 4.76 per cent are assumed to be unskilled workers who play no part in the replacement problem. Of the remainder, 16.45 per cent are presumably semi-skilled operatives.

*(Continued on page 126)*




**Not to be ignored is the continued increase in estimated annual replacement rates; it will be seen that in Cincinnati ratio to total employed has almost doubled since 1910**




**Cincinnati knows ages. Observe the substantially higher percentage of older workers in the metal trades compared with all other industries both in Cincinnati and in Ohio**

# THE ABCs of PERSONNEL

**Remember that executives are judged in the same way machine operators are, by quantity and quality of work they turn out. Next month, S's and T's**


CHARLES S. STEVENSON

*General Manager, Hall Brothers, Inc., Kansas City, Mo.*

SKETCHES BY MATHILDE SCHULZ MUELLER


## *Quality*

Two professors wanted to know what characteristic ranked highest in merit rating plans used by large industrial companies, wrote letters to firms ranging in size from 500 employees to 100,000. But before doing so, each wrote down his idea of what the leading trait would be. One guessed *enthusiasm* . . . the other thought *cooperation* would take first place. Both were surprised when their survey showed that *quality* won top honors. A jolt to the professors perhaps, but not news to management executives who, when they caution, "watch your P's and Q's," generally are referring to personality, quantity, and *quality*.

## *Quantity*

The dean of a school of business asked a refinery manager to address some classes, telling them what industry expects of young men. Here is part of what he said: "I consider *capacity* one of the first three essentials to advancement . . . 'If you wish a job done, give it to a busy man' is being proved correct by busy men every day. Take all the jobs that come along . . . volunteer as opportunities arise . . . take on overtime duties. Important eyes will soon be watching you." Vital: Expect a *quantity* of work from others; leaders themselves must be producers!

## *Reprimand*

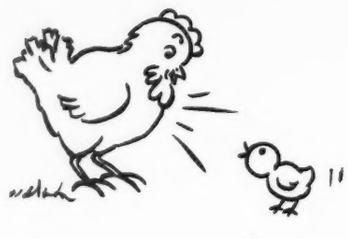
"That Johnson girl certainly can't stand criticism," snorted the foreman to the plant manager. "It won't do any good, but I just raised holy ned with her about some spoilage." "Yes," replied the executive somewhat dryly, *"I heard you* . . . I was passing by . . . noticed some of the folks not working . . . and joined them in listening. A suggestion in handling her might be to consider the old maxim *'It's not what you say, but how you say it,'* and I'd like to add—*and where you say it!"* Observers could point to the fact that the foreman *criticized* while the plant manager *suggested.* It's probably foolish to imply that this one variance was responsible for the difference in rank of the two men, yet—

## *Respect*

"The old man sure has some funny ideas about things . . . I don't think he knows what he's doing half the time," sneered an estimate clerk to a group of fellow-workers. "Well, maybe he doesn't," retorted the assistant treasurer, "but I always figured I'd never scoff at a fellow who built up a million-dollar business and who keeps 200 people at work." Respect for the man above, for his opinion, his judgment, his understanding, is necessary to a smooth-running organization. Scorn and ridicule of leadership is betrayal, and indicates lack of faith and confidence. This, in business as in love, is most devastating.

## *Responsibility*

*There's* a young fellow who was once quite a problem," said an operating manager. "His attitude was only fair . . . folks didn't like him . . . he was indifferent, sluggish, and morose. We were about to release him when, in an emergency, we stuck him on a job to replace a foreman taken suddenly ill. From then on he was a different man and today is headed for a good position. Giving him responsibility *made* him." A colorful story, indeed, but *real* leaders in the making don't stand around sulking until foremen get sick. The voluntary acceptance of responsibility is *watched for* by management . . . to have such a trait means definitely a jump on your competition. Snatch every chance to show your leadership, because the *acceptance of responsibility is a positive requirement for continued promotion.*



# Management Shorts

**Readers are invited to contribute brief articles, illustrated when possible, reporting out-of-the-ordinary management accomplishments. Accepted articles will be paid for**

## PRODUCTION PLANNING AND CONTROL

### Foremen All in One Office

SOURCE

*Zenith Radio Corporation, Chicago*

Better coordination of work throughout the plant has been brought about by housing all assembly foremen in one office. These are not, of course, the line supervisors who watch how Mary Jane and Betty Lou are doing. Rather they are the department foremen to whom the line supervisors report.

Before the company moved to its present plant, these foremen were necessarily scattered on different floors and in different buildings. In the new plant, with all assembly departments on one floor and contiguous, the foremen have one office close to the point where the various lines come together, and hence convenient for each foreman to get out into his own department when he needs to.

Now, with two foremen possibly facing each other all day long at facing desks, contact is continuous and close. If something happens to delay production of a given chassis, the foreman of the department where the delay occurs is, of course, immediately informed. Instead of reaching for the telephone, getting a busy signal, and then forgetting all about the other departments in his concern for his own troubles, the chassis foreman leans across the desk or swivels around in his chair and says, "Hey, Bill, there's only about a hundred No. 2 chassis on the conveyor, and the line's stuck. You better get some more cabinets hustled in for No. 3 and get ready to quit on No. 2 until we get it straightened out." And Bill swings into action without delay.

**All together in one office, these foremen don't have to walk or telephone to confer**

With each foreman constantly informed on every other department's progress and problems, he can anticipate his own problems. Also, working all day with Bill he learns that Bill is not the ogre he seemed when they were separated by five hundred yards and a telephone line. Personal relations among the foremen are smooth instead of knotty.

For further coordination and general understanding, the timekeepers are in the same office. They accumulate the time ticket cost on the basis of standard costs. Every hour a girl picks up the amount produced in each department. She lays this information on the foreman's desk, and keeps an hourly and a cumulative tabulation. Thus, instead of getting the bad news so late that he can do nothing about it, the foreman gets it while it is happening, and he then sails in to make things hum as they should. By having each foreman thus exposed to current information about his own department and about every other fellow's department, things have been speeded up and smoothed out considerably. And the plant management wonders how it ever got along with the old-fashioned method of having foremen and timekeepers all spotted around where none of them could know what was going on outside of his own bailiwick.

•

### "Short List" Expedites Raw Material Deliveries

JOSEPH M. ROBINS

*Yankee Metal Products Corporation*
*Norwalk, Conn.*

Our factory eliminates the possibility of raw material shortages to a great extent by the use of a "short list." If several days before the material is needed the stockroom finds that it has not received that material, it issues a short list to the purchasing department. This list shows the kind and quantity of material needed, department where it is to be used, and the number of the original order and date it was issued.

To the purchasing department this

**DAILY SHORT LIST**

| Dept. | Item | Quantity Needed | Ordered Date | Ordered No. | Shipped Date | Shipped Via | Promised |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| | | | | | | | |

short list acts as a red flag. The telephone and telegraph wires get hot and immediate action is taken. Express and parcel post special delivery shipments are used in order to get material in on time. A great deal of lost time has been avoided by the use of this flagging system.

Before the short list goes to the purchasing department it is reviewed by the production control department, and it is seen again by that department after the purchasing department has filled in the information about the date and manner of shipment of the items in question and the date delivery is promised. In the event then that a change in production plans has to be made, the production department is aware of it, and can change production schedules so as to avoid encountering a shortage of material.

## EMPLOYEE RELATIONS AND SAFETY

### Blackboard Compares Production, Standards, Waste

CHARLES E. HOUGHTON, JR.
*Bird & Son, Inc., Shreveport, La.*

To cut costs and waste a blackboard was built and placed in the men's smoking and recreation room. A record of each day's and previous day's production, and the previously set standard are placed on this board. Also, waste figures.

Figures on this board give the men a running check on standards and what they have accomplished. Production increased as the men became interested in trying to break the standard and the previous day's attainment. They could also see whether waste figures varied with changes in their production. If waste decreased, production increased.

•

### Goggles Keep Safety Before the Eyes

I. MORRISON, *Factory Manager*
*Morrison Steel Products, Inc.*
*Buffalo, N. Y.*

Many plants feel the cost of safety only on the day the insurance premium is paid. For one year thereafter no thought is given to safety. Just let the insurance company worry. It doesn't—it just raises the premium for a bad experience.

I decided to worry all year myself, with the result that my premium has been reduced. I put in force an old idea with startling results. Every person in the plant has to wear safety goggles regardless of whether his occupation is hazardous or not.

No man ever becomes unconscious of the fact that he is wearing glasses and wearing them for safety. The result is that he has safety before his eyes all day long. This proved to be not only the elimination of all eye injuries but it also cut down on all other types of accidents as well, because the men became more safety conscious.

I cut down the cost of lens replacement by developing a special lens coating. This coating prevents pitting from grinding operations and spot weld flashes, and also prevents fogging. While lens replacement costs about 70c. for each pair of goggles, coating costs about 2c., and will give life-long service of the lens instead of the customary one to three weeks in hazardous occupations. So outside of the initial investment our goggles are proving a real safety monitor at no expense.

•

**Leading trade and business publications have been made readily accessible on magazine racks in the shops of the Monarch Machine Tool Company, Sidney, Ohio. Also, a large chart showing the national index of machine tool orders is displayed at each of these convenient reading stations.**

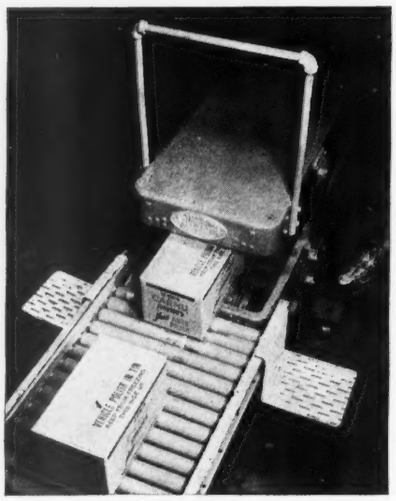
### Two Non-Skid Steel Steps Make Conveyor Crossing Safe

SOURCE
*S. C. Johnson & Son, Inc.*
*Racine, Wis.*

To speed up foot travel and eliminate risk of accident in the filling department where a good many gravity roller conveyors cross the floor, we have movable pairs of steps on which our employees can safely cross the conveyors.

Each step is made of a piece of non-skid steel floor plate, made at a local boiler shop according to our design. It is about six inches wide, with rounded lower corners, and is bent so that it consists of a tread, a riser, and an upper lip about two inches across. This lip is drilled twice, tapped, and has in each hole a machine bolt screwed down to the head with the bolt projecting downward; no nut is used. The frame of the conveyor is drilled with slightly larger diameter holes to admit these bolts.

To attach the steps to the conveyor it is merely necessary to slip the bolts down through the holes in the conveyor frame. A step goes on each side of the conveyor. So the employee or supervisor who has occasion to cross a conveyor line merely uses the steps instead of vaulting or climbing across the frame itself. Adjacent to the points where steps are used, a pipe yoke is set on the frame to serve as a handhold; the yoke is high enough to clear the packages carried by the conveyor.



Each conveyor section is drilled at the end to take a pair of steps. When the sections are shifted, the steps are shifted always to the position next to the sealing machine—which is the point where everybody wants to cross. The whole device cost very little, and has taken the risk out of this common shop practice of crossing conveyors.

# MAINTENANCE SERVICES

## SELECTION • INSTALLATION • INSPECTION • UPKEEP • ORGANIZATION

**People and machines engaged in production must be supplied with buildings and with many services, such as electrical and mechanical power, heat, light, water, sanitary facilities, air conditioning, ventilation, dust collection, protection, communication, housekeeping. Providing these services and keeping them in condition for efficient production constitutes the Maintenance Service function. ¶ Practically every activity of maintenance service has to do with the Selection, Installation, Inspection, or Upkeep of equipment. For the benefit of FACTORY'S readers these classifications are carried at the top of the first page of each major article, and check marks are set against the classifications to which the articles belong. A fifth classification — Organization — is checked when the article deals with maintenance department organization and direction**

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**FACTORY MANAGEMENT AND MAINTENANCE**

**McGRAW-HILL PUBLISHING COMPANY, INC., 330 WEST 42d STREET, NEW YORK, N. Y.**

# EDITORIALS

L. C. MORROW . . . *Editor*

## Does Your Plant Have All-Time Maintenance Protection?

BELIEVE IT OR NOT, there are times when a plant wakes up to the fact that it is operating without complete maintenance protection. Consider the continuous-operation plant. Chances are its daytime operation will be protected by a full maintenance force. Chances are, also, that there will be a skeleton force on at night.

In fairness to this arrangement it should be said that not always is it as risky as it looks. In some cases of the kind, definite programs of preventive maintenance are followed during the day; and most of the construction, designing, erecting, and dismantling jobs are planned deliberately for daylight operation.

But plenty of maintenance men are called out of bed—not occasionally, but frequently—to get down to the plant in a hurry to meet a breakdown situation. That's tough on employees, and it's also tough on the payroll, calling for at least time and a half.

A suggested remedy is re-allocation of the maintenance forces. It may be possible to more nearly equalize the number of routine jobs done in the daytime with those done at night. There would be a payroll increase, probably, because of the customary higher rate for night work. Also routine work probably would proceed at a lower rate at night.

But against these disadvantages would be set the advantages of better insurance for production; less work at overtime rates; regular work and rest periods for employees. Seems to be worth looking into.

## Maintenance, Too, Is Responsible for Industry's Product Costs

ON ANOTHER PAGE of this issue we mention the forthcoming November issue, "Quick Ways to Profits." There we refer to the need for reduction in product costs.

Note that product costs are not influenced alone by costs incurred in the production operations. The final product must be sold for enough to cover all the direct costs of the production operations, plus all indirect labor and overhead costs, plus profit.

This means that maintenance has the same obligation as production—that is, to operate as economically as possible. Obviously "Quick Ways to Profits" will be as useful to maintenance as to production. That is true because the issue will be devoted to the single objective of stimulating the men responsible for plant operation to devise new methods of cutting costs.

There are many ways to cut costs; opportunities exist in all subdivisions of maintenance, from organization of personnel to elementary operations like cleaning floors. And there are many maintenance men to take advantage of the opportunities, because it's a rare individual who is doing his job as well as it could be done.

## Better Unit Heaters for Less Money

WHEN ANY NEW kind of equipment appears on the market, it is almost inevitable that the product of each manufacturer will differ in important details from that of the other makers. Unless the industrial user adopts one manufacturer's product exclusively—which is not always desirable, or even possible—he is faced with the necessity of carrying a variety of spare parts, and may find it difficult or impossible to interchange units.

Standardization, which eventually takes place, removes many of these difficulties for the user. Incidentally, it is of decided benefit to the manufacturer as well, and in the long run leads to economies that can be passed along in the form of reduced prices.

The Industrial Unit Heater Association has recently called attention to the work it has been doing, such as the standardization of piping and motors. For example, the number of motors specified for use with unit heaters has been reduced from more than 1,000 to about 50.

Since 93 per cent of all unit heaters sold are manufactured by members of the association, practically all users of this equipment are getting the benefits, in the way of lower prices and quieter, more efficient units, which close collaboration of the leading makers has made possible.

✦ ✦ ✦

"I RECENTLY READ that cost of electrical power and utilization equipment varies from $\frac{1}{4}$ to 4 per cent of total cost of manufactured products. Also, that cost of power distribution system is only 20 per cent of this amount, while cost of power consumed is 80 per cent.

"If this statement is only half true, plants with millions of dollars in machinery depending on electrical power can afford to be liberal almost to the point of extravagance in providing an adequate electrical distribution system."

We endorse most heartily this comment from a reader.

What the 1938 hurricane did to a mill that wasn't cautious enough to anchor its roof

# Watch Out for the Wind

**A roof may go in the next stiff blow unless the maintenance department recognizes wind damage dangers and prepares to meet them. A second article, in October, gives construction details for adequate roof anchorage**

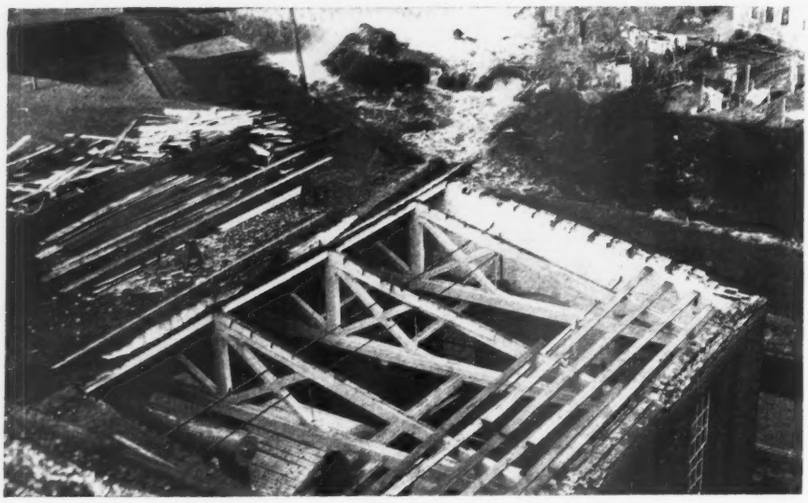
HERBERT A. SWEET
*Engineer*
*Associated Factory Mutual Fire Insurance Companies, Boston*

WINDSTORMS of considerably less magnitude than New England's 1938 hurricane do most of the wind damage suffered by industrial properties, and it is against sudden squalls and high gusty winds accompanying local storms in all parts of the United States and Canada that maintenance men must protect their plants. In storms of this type, although the average 5-min. velocity—the velocity reported by most weather bureaus—may reach 60 to 80 miles per hour, instantaneous gusts may run up to 75 to 100 miles per hour, or even higher.

Maintenance plays an important part in the resistance buildings offer to windstorms. Windows that are poorly anchored may blow in. Stacks and signs may fall, unless well designed and properly erected and cared for. Roof covering may be lifted, and skylights and ventilators may be broken or damaged, either by direct wind action or by flying debris. Rain entering uncovered roofs may cause serious water damage.

By far the greatest damage, however, is due to the lifting of unanchored wooden roofs, monitors, and skylights. These are easily lifted, folded back, or torn away by winds of average high intensity. Roofs frequently pull in building walls when lifted, and falling brickwork and timbers damage valuable machinery and cause costly interruptions. Rain accompanying windstorms, and water discharged from broken sprinkler piping, drench the unroofed areas, the water often leaking through floors and wetting down materials and machinery in the stories below.

According to the old theory, the wind lifts flat or moderately pitched roofs because of its prying action under wide, overhanging eaves, or by entering buildings through broken windows or other openings and exerting upward pressure on the underside of the roof. Recent wind-tunnel tests, however, have proved that there is another important action involved. When wind strikes a building, it is deflected upward so that an area of reduced pressure is produced over the entire surface of the roof. The normal pressure inside the building, then being greater than that outside, tends to lift the roof. This pressure is greatest along the windward eaves and is sufficient to fold back and lift off the usual joisted or plank-on-timber roof, if the roof is not properly anchored. The lifting force is increased if the roof has an overhanging cornice under which the wind can apply a prying action, and if



**Lifting of roof with windows and walls intact illustrates uplift force of the wind deflected upward at the windward wall. Overhanging cornice helped wind to get a grip**

**On a built-up roof, the lower layer of insulation remained in place as the wind folded back upper layer and the roofing-felt covering. Better nailing down helps prevent this**

the wind breaks windows, enters the top story and increases the air pressure inside the building.

Damage to roof coverings is another form of windstorm damage. Flashings at roof edges are often not securely fastened or are not well maintained, with the result that the wind gains a foothold along the eaves and forces up extensive areas of the covering. This applies to all types of built-up and prepared roofs.

Windstorm damage to built-up roofs involves both the pulling out of nails from the roof planks and the pulling of nail heads through the lower felts, where there are too few nails or the felts are weak. In order to obtain a good built-up roof, it is advisable to order at least a 15-year-guarantee roof covering and to have the guarantee include the flashings. It is also advisable to inspect the flashings occasionally to determine that they are not loose or weak.

Blistering of smooth-surface built-up coverings may cause considerable trouble. These blisters should be cut out and patched with asbestos felts. Nail and mop liberally.

Slate and unanchored tile of light and moderate weight are damaged considerably by very strong winds, unless properly fastened down. Nails in slate should preferably be of copper. Tiles should be anchored unless the total weight is in excess of about 30 pounds per square foot.

Composition shingles of better grades, carefully nailed, experience relatively little windstorm damage.

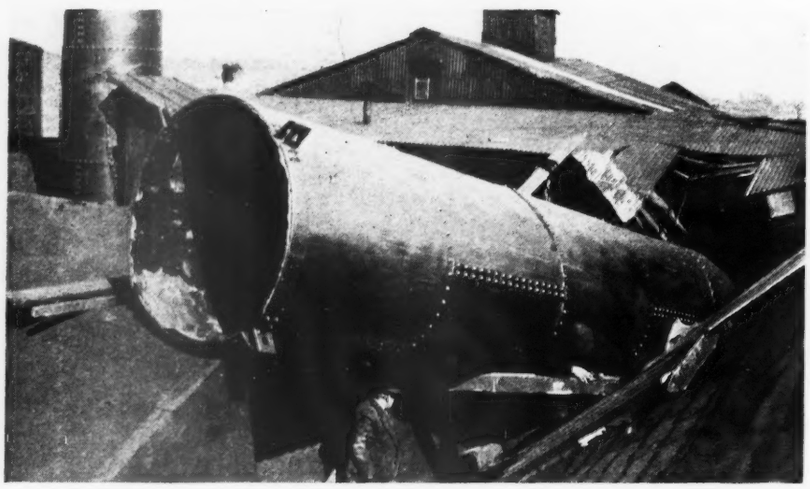
Considerable damage occurs to tin roofs when nails are few or when they are driven into rotted wood. Liberal nailing, and protection of nail heads against corrosion by soldering or concealment in interlocking seams, are essential for good service.

Wind damage to skylights is due chiefly to insufficient anchorage to the building framework, and also to insecure fastening of glass in skylight frames. When letting a contract for skylights the plant engineer should specify that construction be adequate to resist a 30-lb. per sq.ft. wind.

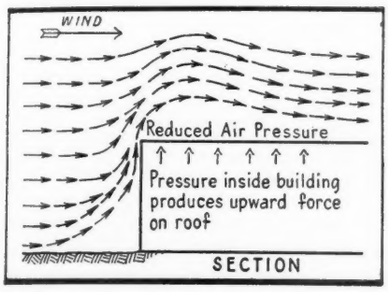
## Check Coping Tile

A large amount of damage is done to and by coping tile. The glazed surfaces on such tiles have little or no bond to the brick parapet walls. Consequently, the tiles may become loose after a short time, and then are easily dislodged by the wind.

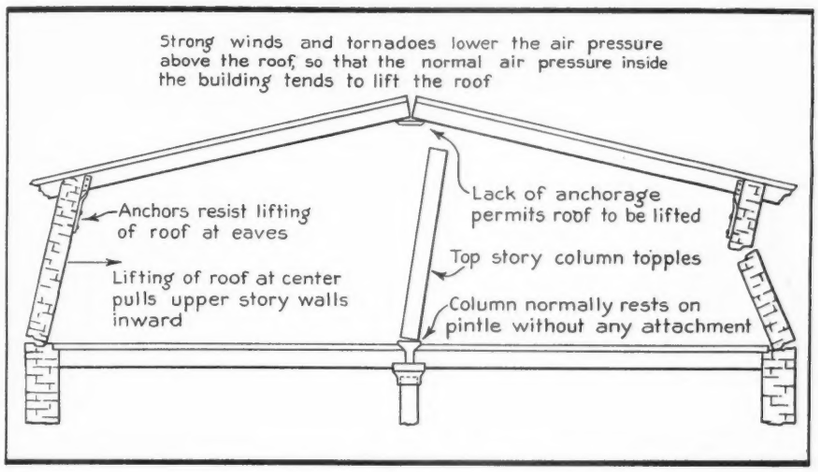
During the 1938 hurricane, concrete or stone block copings were damaged more than would have been expected,



**The wind found an easy mark here. Metal behind the collar where the break occurred had been corroded to paper thinness, so that the stack offered little wind resistance**




**When a strong wind strikes a flat-roofed building broadside, it produces an area of low pressure over the entire roof, greater near the windward side, with the result that the normal, higher pressure inside the building produces an upward force on the underside of the roof and tends to lift it**


Strong winds and tornadoes lower the air pressure above the roof, so that the normal air pressure inside the building tends to lift the roof
Anchors resist lifting of roof at eaves
Lack of anchorage permits roof to be lifted
Top story column topples
Lifting of roof at center pulls upper story walls inward
Column normally rests on pintle without any attachment

**How a roof may be lifted if it is anchored at the outer wall but not at the columns**

considering their weight. This leads to the conclusion that definite anchorage to the brickwork should be provided, or continuous poured-in-place copings be installed. Continuous copings have the advantage of furnishing greater uplift resistance at the end of roof beams.

Although metal coping frequently was not damaged by the hurricane, extensive damage occurred in some instances as a result of not adequately fastening the metal to the masonry. With proper fastening, metal coping should furnish excellent wind resistance.

## What to Do About Signs

Large, well-maintained sign structures whose designs have been checked against maximum wind forces, and whose construction has been properly inspected, come through the strongest winds without injury. However, many small signs which have not been inspected from a structural design basis are frequently damaged or completely wrecked. The chief weaknesses are lag-screw anchorages to roof planks, absence of suitable diagonal wind bracing both in the face of the signs and in the plane of the "*A*" frames, and apparent failure to consider the horizontal wind forces which exist at the base of a sign in addition to the vertical loads.

All signs should be designed for wind loading in any direction of about 30 pounds per square foot of projected area. Lettering should be substantial, securely attached to runner angles, and maintained in good condition, as corrosion of thin metal sheets and clip fastenings is rapid.

Frames and mullions of large metal-frame windows, and fastenings to masonry, should be designed to resist a wind pressure of 30 pounds per square foot. Wooden sash is usually of smaller size and therefore not subjected to such large total wind forces. Maintenance, consisting of painting of metal and wooden sashes, replacement of rotted material, and provision of good anchorage, is essential.

The large amount of glass breakage is due mostly to debris blown by the wind. Any dead trees or branches near buildings should be cut down; any branches that are close enough to break windows when swayed by the wind should also be removed. Loose gravel from tar and gravel roofs frequently causes much breakage; nevertheless such roofs, on account of their superior fire resistance and appreciable weight, furnishing partial resistance to lifting in windstorms, are regarded favorably. Loose gravel, however, should be removed, although there should be enough embedded gravel or slag to protect the tar from the action of the sun.

Large sliding or swinging doors should be provided with fastenings and properly braced or supported to withstand the specified wind loads. Steel doors of the rolling type should be inspected frequently and maintained in good working order. Doors of this type are often injured by trucks or through constant use, so that they do not operate smoothly within their side guides. Or they may even come free of the guides so that they flap in the wind and are further damaged or torn loose.

To effect economy in chimney construction, it is common practice to use less brickwork in radial brick chimneys, and to depend on the bond between the mortar and the bricks to hold stacks down rather than the total weight of the chimney. The result is that under wind pressure large diagonal tension cracks have developed in the middle or lower portion of a few such stacks, necessitating extensive rebuilding. This would not have been necessary if the chimneys had been designed as gravity sections. Chimneys should be designed for a wind load of 20 pounds per square foot of projected area, and without any tension on any section.

Considerable repointing of many chimneys is necessary because of mortar in the joints blowing away. The need of more cement in the mortar is indicated by such experiences.

## Care of Metal Stacks

Metal stacks should be hammer tested and carefully inspected annually so that repairs or replacement can be made before the plates become so corroded and weakened, or guys and fastenings so deteriorated, that winds will cause damage.

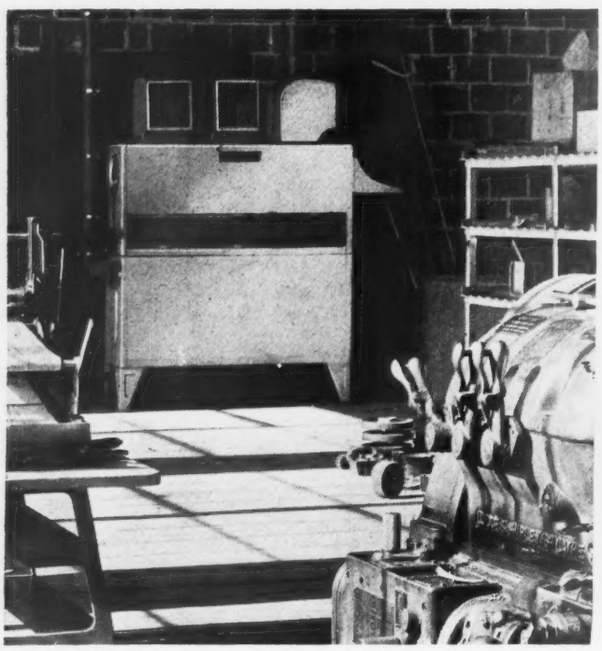
Traveling unloading towers and cranes are frequently not provided with clamps or brakes that can safely resist a maximum wind force of 30 pounds per square foot on the projected area of the structure. Such safeguards are needed for all such structures, and should preferably be applied automatically whenever the driving power is shut off. The watchman should determine on his first round that these clamps and brakes are properly set. It is very important that the rails be kept planed free of beads or fins if there are rail clamps that depend on friction along the rail for their holding resistance.

In view of possible interruption to plant operation and fire pumps, it is most important that supports for power lines be made adequate to withstand maximum wind forces. They should, if possible, be located where falling trees will not break wires.

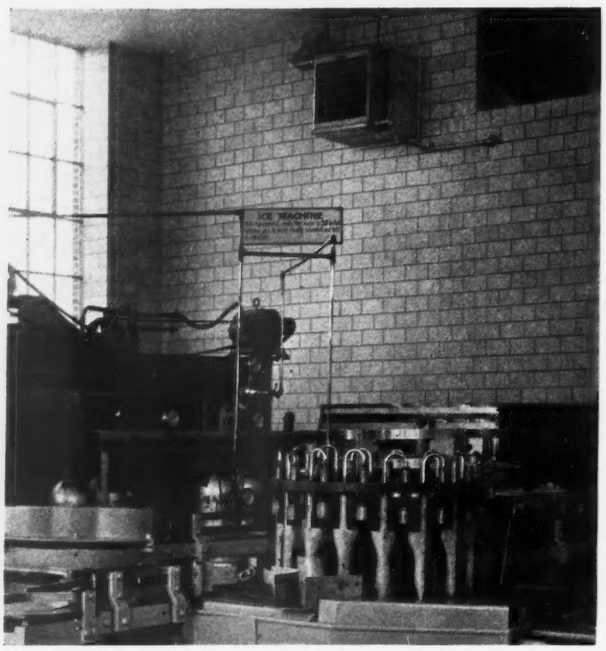
*Mr. Sweet's second article will appear in October.*—Ed.

# UNIT HEATERS
# Warm the Right Places

Galvanized roofing plant has 24 unit heaters (Modine) to maintain constant temperature, keep air moving so that steel sheets stay dry

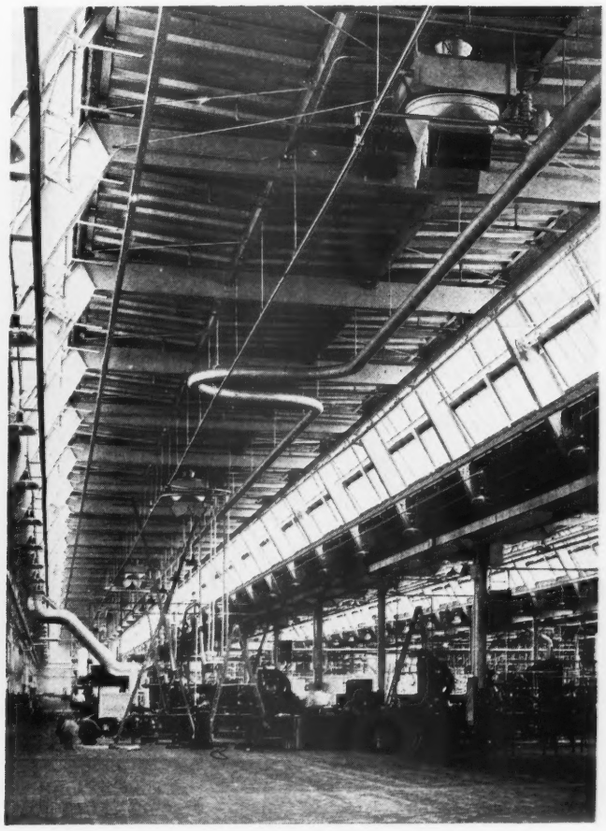


Floor-type unit heater (Buffalo Forge) serves in a machine shop

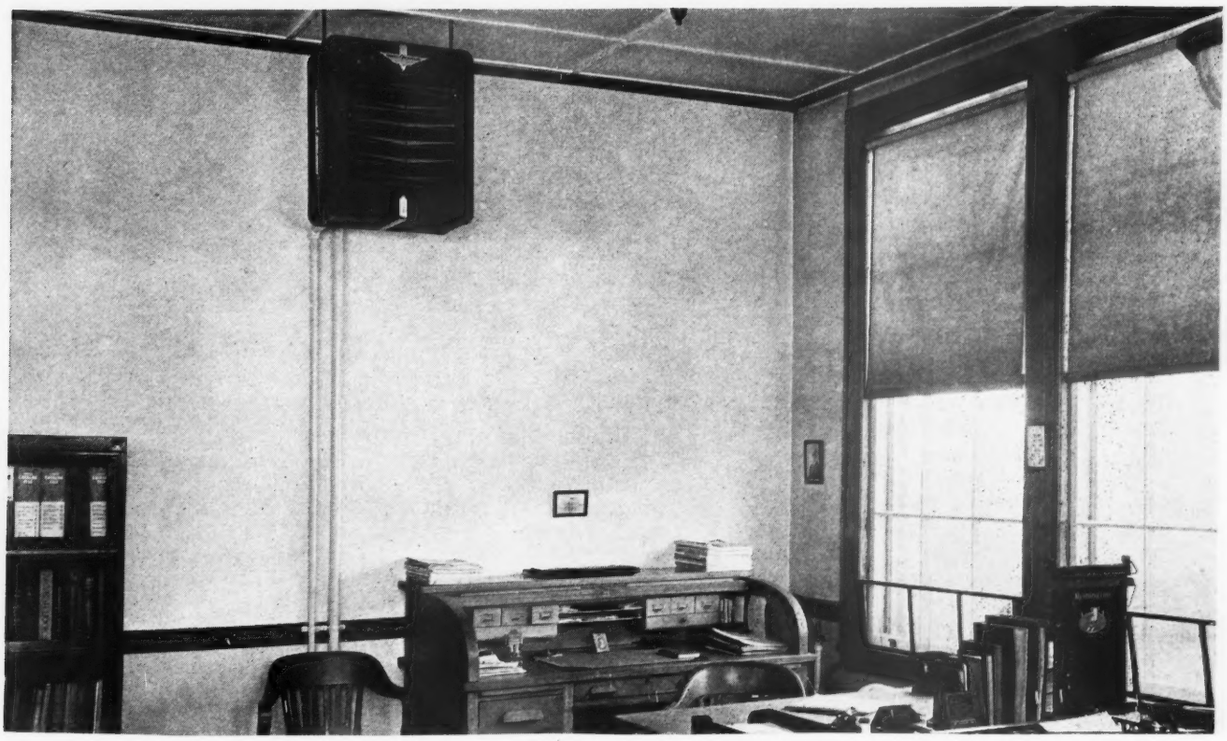


Seven of these units (B. F. Sturtevant) keep a bottling plant warm

Two floor units (Carrier) heat an area of 40,000 square feet



Revolving-discharge heater (L. J. Wing) distributes heat evenly



Providing heat in winter, air circulation in summer, a unit heater (Grinnell) can be used in the office as well as out in the plant

# What About Incentives for Maintenance?

**No elaborate study this. The editors simply asked half a dozen plant men for their opinions. Anyone else who's had experience, good or bad, is invited to toss it in**

FACTORY'S EDITORS count that week practically lost in which someone doesn't write in for information about incentives for maintenance.

Now the fact of the matter is, there have been plaguy few recent contributions to management literature on this subject. A few companies, we knew, had applied incentives to maintenance work, but mostly they wouldn't talk or else felt they hadn't had enough experience to talk.

It seemed to be our job, therefore, to ask half a dozen people how they felt. So we did. And discovered that the men who operate plants in industry—we think our half-dozen are a fair sample—are either pretty hot or pretty cold, seldom lukewarm, about such incentives.

For example, two of the three ensuing discussors are heartily in favor. The third has had had an unsatisfactory experience.

Number 4, who insists on anonymity, goes Number 3 several better. Says he in part:

"While with Blank & Company (a nationally known firm of consultants) I had to decline a maintenance incentive job that was dropped in my lap. The job would have covered some 800 men, and the fee would have been in the neighborhood of $30,000. Off the record I do not hesitate to tell you that it was for no other company but ——— & ———. They had made two attempts at incentive systems in their maintenance shops and each time wound up behind the eight ball. They wanted us to do a research job on the subject and devise a scheme in their maintenance department that would be equitable to all concerned. Our initial research was sufficiently discouraging for us to decline the job.

"You know as well as I do that management engineers do not turn up their noses at jobs if they have so much as a 50-50 chance of putting them across. It boils down to this: I am in no way convinced that a bang-up maintenance job can be done."

Which those on the other side of the fence will doubtless dismiss as "just one man's opinion."

The chief engineer of a candy manufacturing concern would certainly feel that way about it. He writes:

"Employees of our organization are not permitted to undertake commissions such as you outline. However, we do have a wage incentive plan for maintenance and are well satisfied."

"Our present belief," says Number 6, "is that we would rather pay our men a good rate of pay on an hourly basis and obtain good mechanics who would warrant that pay. Under these conditions we have found the men very conscientious about their work."

Number 7 thinks that "while a bonus plan can work successfully in small groups for maintenance and repair work, it would be unwise for us, in view of the general attitude of the unions, to do any experimenting."

All this, admittedly, is scant evidence upon which to base conclusions as to the value of maintenance incentives as a practical tool of modern management. However, it may serve to stimulate others who have lived with such incentives to toss their experiences into the common pot.

## Putting Maintenance on a Competitive Basis

E. J. KAGEMANN
*Industrial Engineer, Bakelite Corporation, Bound Brook, N. J.*

THERE IS NO LOGICAL REASON why the competitive system should not be extended to the industrial maintenance department. In the past it was thought that there was an enormous amount of detail involved in setting up standards of performance because of the non-repetitive type of operations, and the lengthy duration before completion of some maintenance orders discouraged the application of these standards. Both of these statements are easily disproved.

Maintenance labor is made up of several classes of work such as electrical, millwrighting, pipefitting, tinsmithing, welding, carpentry, machining and machine repairing. Each taken separately and studied will indicate a constant repetitive type of operations which can be time studied and simplified. Labor standards of performance can be set up which will provide an accurate means of estimating labor required on all types of maintenance orders.

To shorten the period of time for completion of the maintenance order, it has been found practical to subdivide the orders into detailed functions and to describe these with suffix letters of the alphabet and numerals, the letter indicating the function and the numeral a specific operation.

To illustrate this further, the first electrical item in the installation of equipment was the installation of a ¼-hp. motor. This would be described by using the maintenance order number, followed by an "E" representing the electrical

work, and a "1" to indicate the first item in this class of work. In a like manner, subsequent electrical work would be described with the suffixes "E2", "E3", etc. In this manner it is possible to eliminate much of the "Work in Process" and definitely locate deviations from standard performances. It is also found advantageous to write individual orders for each of the functions on the maintenance order.

The orders given to the maintenance department operators should indicate the standard performance time for the work they are to perform. This will eliminate misunderstandings due to the misinterpretation of an order as well as indicate to the operator what is expected of him. The time standards set up are based on normal output plus personal and fatigue allowances, and for performance above normal the regular hourly rate is applied to the time saved. This provides the personal interest for the operator and places him in a comparable position with the contractor whose earnings are commensurate with the efficiency obtained from his employees.

## Operating Time Has Been Reduced 40%

**E. M. RICHARDS**
***Assistant Vice-President in Charge of Operations***
***Republic Steel Corporation, Cleveland***

TWENTY PER CENT OF THE TOTAL working force employed by Republic during full operations is used to maintain plants, mines, and production facilities. With such a large group of craftsmen you can estimate what their payroll must be, and how much money might be lost if some dependable approach for repair costs were not employed.

To cope with this situation we attempt to observe three fundamentals:

1. Use production equipment of most suitable material and design.

2. Take care of this equipment.

3. When repairs must be made, make them efficiently.

We attempt to attack this problem from several angles. First of all, we focus the leading maintenance department brains on our major problems through our maintenance committee, composed of the master mechanics of the corporation, and through our tool and die committee, composed of the tool designers, toolroom foremen, and metallurgists of our fabricating units. These committees criticize constructively each other's plants, exchange ideas, and advise the operating men on equipment upkeep. Second, we use incentives in the maintenance departments.

The incentive to use production equipment of the most suitable material and design and to take care of the equipment, the first two fundamentals listed above, is obtained by making the foreman cost-conscious and rewarding him for reducing costs through our foreman bonus plan.

The incentive to make repairs efficiently, the third fundamental listed above, appears on the surface like an insurmountable undertaking. Many concerns contend that there can be no standards of repair work because jobs are seldom repeated and practically every job is different. Republic has taken the position that there can be standards on this type of work.

In our machine shops, for example, time-study standards have been set for each operation of every machine, and from these studies formulas and tables have been established. When a job order comes to the machine shop for a repair part, the estimator determines the machine tools to be used, the operations for each machine, and the allowed time for each operation. The machinists are informed of this allowed time and are paid in proportion to the time they have saved over the allowed time so calculated. This system has been carried into other shops, such as boiler, welding, pipe, locomotive repair, and electric repair, and has proved satisfactory.

Time values based on time studies also have been worked into formulas and tables for such operations as laying a pipe line, digging a ditch, welding a piece of machinery, painting or sheeting a building, rebuilding an open hearth, relining a blast furnace, and so forth. These formulas are used to set a contract on repair and maintenance work outside of the shops.

The question may be raised as to what, if anything, these incentives save. Our answer is that a saving cannot be attributed solely to the incentive, as the efforts of all concerned should produce some saving without an incentive. However, the fact remains that there has been a saving. Here are some of the facts:

1. By taking a number of jobs that have repeated themselves in the repair shops, the operating time, since the advent of incentives, has been reduced 40 per cent.

2. Our repair cost per unit of mill production shows substantial reduction over that of former years.

3. It is difficult to compare repair costs between steel companies because they have differences in accounting, specialize in different products, and have different types of plants.

For example, Republic, in addition to its coal and ore mines and steel plants, has 26 plants and 33 warehouses in its subsidiary and fabricating divisions. Whatever the figure means, the repair cost of Republic with its subsidiaries and divisions, is substantially below that of the average of the steel industry.

The criticism may be raised that such savings could be accomplished through slighting repairs. Republic checks this constantly. We feel that our equipment is in good shape. We stress the fact that it is a costly practice to slight repairs because, in the long run, such a policy increases costs instead of reducing them.

As stated at the outset, a vulnerable point in the operating cost of a manufacturing concern may be the lack of measuring sticks on maintenance costs. In Republic we have attempted to meet the situation by using the controls and incentives outlined above.

## We Tried Incentives, But Abandoned Them

**FREDERICK S. KRIGER**
***Assistant Plant Engineer, Corning Glass Works***
***Corning, N. Y.***

INCENTIVES IN MAINTENANCE WORK were tried in our mechanical trades group over a period of about three years using a system under which each individual job was estimated and the number of hours required to complete the job was set. If a man doing the job came under this estimate, he was paid for one-half the number of hours saved at his regular rate, and the company was figured to have saved the other half.

It was proved on many occasions that real savings were made, based on the time required to complete identical jobs before and after the system was installed. But the system finally was abandoned because of certain disadvantages that were found very difficult to overcome. The most noteworthy of these follow:

One big difficulty is that in maintenance work so many of the jobs that come up do not repeat themselves. There is such a variety of jobs ranging from those requiring only a few minutes to those requiring weeks of work that it is hard to estimate the time required accurately. If the estimate is not fairly or accurately made, either the man or the company suffers a loss.

Thoroughness is the secret of good maintenance. This type of incentive system has a tendency to encourage rushing a repair job and possibly overlooking or passing by things that may cause future interruptions to production.

This same tendency may result in accidents to the workman because when he is working against time he may take short cuts and chances that normally would not be tried.

# Maintenance Is Insurance

A. E. WINDLE

*Plant Engineer, Colgate-Palmolive-Peet Company*
*Jersey City*

ONE DAY RECENTLY one of my foremen commented on how lucky he had been to have on hand a complete stuffing box for a certain pump when it was rather suddenly needed for replacement. My rejoinder was, "Lucky hell, Ed, that's good management."

This man knew what I meant. He had learned through years and years of experience with the particular pump and the material it handles that those stuffing boxes might be needed on short notice; if they were not available a whole department, employing many people, would be shut down, produc-

**Plant engineering—and that means delivering maintenance services—has been the life work of A. E. Windle. To be sure, he was in the Army Air Service during the World War. But, with the exception of his service years, he has done plant engineering of one sort or another ever since he got his mechanical engineering degree at Boston Tech.**

**Windle wrote the accompanying statement against a background of maintenance experience with International Time Recording Company; Tide Water Power; Corning Glass Works; Wilbur-Suchard Chocolate Company; Kroger Grocery & Baking Company; and, of course, his present company.**

**Like the other authors in this series, Windle wants to see his chosen profession have the high standing it deserves. But, also like them, he presents the case always from the angle of the welfare of the plant. It's the job, not the man, he pushes forward.**

# Against Plant Shutdown

tion lost and pay lost, with all the "intangible" losses added. It had long since become his custom to see that the spares for insurance against shutdowns of this and many another similarly important piece of equipment were on hand and ready for use.

Foremen, master mechanics, and plant engineers are today making themselves indispensable parts of plant operation and production, not only by serving when there is trouble, but by serving in advance of it.

Management is recognizing this. Instead of maintenance being looked upon as a burden or necessary expense around the plant as formerly, it is being recognized as an integral part of the operating set-up—a necessity for continuity of production—a unit of an effective organization.

Maintenance shops are being equipped today with modern machine tools, pipe cutting and threading machines, and time-and-labor saving devices of every sort, just as the production departments of plants are equipped. Attention to these facilities pays management well.

### Filling the Gaps

Men skilled in their respective crafts are being employed as maintenance men, and where possible apprentices are trained in the trades for future maintenance work and to fill gaps as they occur.

These are distinct indications as to how modern management regards the maintenance function.

Maintenance is most successfully carried on as an engineered operation in the plant. Depending upon the plant requirements, more or less of a staff may be involved, of course, but the work is carefully planned for the most economical and expeditious execution. It is planned so that interferences with production will be minimized.

Records are kept of work done so that useful machine or part life may be forecast and preparation made to prevent any piece of equipment from becoming a chronic annoyance or obstacle to production. Proper records also make it possible to forecast for budgetary purposes the expected maintenance costs.

Any plant or manufacturing process, however large or small, represents an investment from which some return and profit must accrue or business cannot go on. Therefore the producing units must be kept in service and the people in the plant kept occupied in order to turn out the product from which the return on the investment must be obtained. Idle machines and workers turn out no product. Careful planning and foresight are necessary to keep the plant in operation from end to end.

### Producing a Return

Although the buildings of a plant are not producing units, the equipment housed therein must produce a return on the investment represented by the buildings. Therefore the buildings must be well maintained against the ravages of age and fire, and the elements.

Perhaps by choice or perhaps by force of circumstances some managements have in one way or another reduced maintenance of the plant property as a whole for certain periods. To their sorrow they have eventually seen that the need for maintenance goes on relentlessly and is decidedly cumulative. The burden of restoration may be harder to bear than that of continued upkeep because it presents a peak demand on resources when management finds it must repair and replace.

Careful planning and execution of maintenance work will permit it to be carried on in the most economical manner—economical not only from the viewpoint of its own direct cost but also from the viewpoint of tangible benefits obtained from having plant, equipment, and consequently men, continuously available for production requirements.

The morale of an organization is improved if the workers know that the equipment with which they produce and earn their own living is well maintained, assuring them from day to day and week to week some certainty of income—as contrasted to trying to produce with rundown or constantly failing equipment which makes their regular employment and pay a doubtful or fluctuating source of livelihood.

Reference has been made to training maintenance employees. No matter which of the several trades or crafts may be concerned, it is necessary for a man to have real training or long experience to become successful and valuable at maintenance. He must have broad qualifications and be able to turn his hand easily and rapidly from one sort of problem to another in almost endless succession. He scarcely ever has any routine. He would seldom be successful in the construction trades—nor would the construction man be likely to succeed at maintenance.

Maintenance employees are a pretty steady lot. Once having become trained or experienced in one plant or industry, they are likely to stay with their employer indefinitely, if he will have them. And it behooves the employer to hold on to good maintenance people when he once gets them. Labor turnover in a maintenance force is sometimes very expensive.

### By Their Skill They Save

Maintenance men are not just repair men. By kinks they know, by tricks of the trades they practice, and by skilled execution of their duties they save many production shutdown hours. From their intimate knowledge of plant, equipment, and process, they can and do make suggestions which solve many knotty production problems. Occasionally the inventive genius of maintenance develops or improves devices or machines that make handsome returns, or save investment in expensive facilities.

This ability to solve problems may exist as latent power almost anywhere, but unless discovered and encouraged it may never be known to exist. The employer may well take his maintenance people into his confidence and confer or consult with them regarding his problems. This is not only a good gesture to build self-esteem in the maintenance force, but also lets these men realize what they actually are—an integral part of the operating and production set-up of the plant.

# 7 Jobs for Electric Heat

1. **Bakes the finish on large circuit breaker tanks**
2. **Keeps sunburn ointment liquid during packaging**
3. **Heats paraffin for impregnating milk bottle caps**
4. **Dries shoes for final finishing**
5. **Melts compounds and performs other services in wire and cable manufacture**
6. **Dries and warms beverage bottles before labeling**
7. **Warms molasses to allow pumping in cold weather**

**G. A. VAN BRUNT**
*Associate Editor*

ELECTRIC HEAT has long found wide use in industry, where its applications are about as varied as the processes employed. Reason for this universal use of electric heat lies largely in its high degree of versatility There are cheaper forms of heat, but whatever disadvantages this feature may impose are commonly more than offset by the ease of applying it at exactly the point desired; the accuracy with which temperature can be controlled automatically; the absence of gas, dust or smoke; and the comparative freedom from fire hazard.

Here are a few examples of how electric heat has solved manufacturing problems and accomplished results that could hardly have been secured in any other way.

**1.** A large part of the orders for circuit breakers received by the Condit works of Allis-Chalmers, Hyde Park, Mass., required only air-dried paint finishes. When changes in design and the specifications for outdoor breakers made it necessary to use baked finishes, an important problem was presented. The paint manufacturer would supply a finish of superior qualities if the baking temperature could be accurately controlled. The oven must bake evenly, with a small or large load. From the standpoint of production it was desirable to have the oven portable, because at times the parts to be baked are set up on the production line and it is preferable not to move them.

Steam heat was considered, but it was available only at a limited number of points. Handling of a portable oven would result in leaky steam pipes. The practical difficulty of applying accurate temperature control, and avoiding temperature swings which would materially affect the quality of the work, however, was the most important reason for discarding steam as a heating medium.

A 50-kw. cylindrical electric oven was eventually adopted as the solution. It stands 16 feet high, and is 9 feet in diameter, outside. One hundred strip heaters each of 500-watt rating, evenly distributed around the bottom duct, can preheat the oven to 250 degrees Fahrenheit in 45 minutes. Asbestos-magnesia insulation 4 inches thick effectively prevents loss of heat. Adjustable louvers in the two upper circular ducts and a recirculating blower of 360-c.f.m. capacity assure even heat distribution and quick transfer. An indicating control holds the temperature within 10 degrees of the setting.

Built in the form of two half-cylinders, the oven is hinged along one edge and provided with bolts and lugs for firm closing along the other edge. Mounted on roller-bearing wheels, it is easily opened and closed. An 18-in. hole in the top, with removable cover, gives ample provision for venting volatile products of the baking operation.

The shop crane easily carries this 5,000-lb. baker anywhere around the shop. Power circuit outlets are available every 25 feet along the factory floor for easy connection with the 20-ft. flexible cable attached to the oven.

Satisfactory performance has been amply demonstrated in nearly three years of service. Three coats of paint can be baked in 10 to 15 hours, depending on the types of prime and finish coats, as compared with the 24 to 48 hours required to dry one coat in the air. The result, of course, is a big saving in the time needed to finish the parts, and the release of floor space for other purposes.

With all these advantages, efficient application of heat and a power rate of less than 2 cents per kilowatt-hour, make the cost of baking the finishes comparatively low.

**2.** From drying paint to playing an important part in the manufacture of sunburn ointment is quite a step, but not too big for electric heat. This application is in the plant of The E. W. Rose Company, Cleveland.

Formerly the containers in which the ointment is marketed were filled with the cold material, and the excess was scraped off, leaving the level flush with the top. When the lid was put on, however, some ointment was almost certain to be smeared over the sides of the tin. This situation was annoying and increased labor costs.

Now, after the ingredients have been properly prepared and mixed, the ointment in liquid form is transferred to the container of the filling machine. The container and the pipes leading to it from the mixer, and from it to the filler head, are provided with strip heaters embedded in insulation. Purpose of the heaters is to keep the ointment at 110 degrees Fahrenheit until it has been poured into the containers. Close temperature control is necessary; if it drops a few degrees, the ointment congeals. On the other hand, too-high temperature impairs the quality.

Thermostats automatically keep the temperature of the material in the filling machine at the proper point. On the filler pipes manual control of the heat by three-heat switches is considered more satisfactory, since the problem is not one of maintaining a constant temperature.

This filling machine has an output of 50 1-oz. tins per minute. Thanks to electric heat the losses in packaging have been cut from their former value of 2 or 3 per cent to 0.055 per cent.

**3.** A manufacturer of milk bottle caps used to heat with steam the paraffin used in impregnating the caps. One man came on duty around 3 o'clock in the morning to fire the boiler.

This method of heating the paraffin worked, but not so well that there was no room for improvement. Because close and uniform temperature control is important, and can be secured so easily with electric heat, one kettle was equipped with two 4-kw. immersion heaters and individual thermostats.

This trial installation proved so satisfactory that within a few months all the kettles were changed over. Results were more accurate control of temperature than was formerly possible, a better product, and improved working conditions in the way of lower room temperature and less vapor in the air.

**4.** By replacing steam coils in drying racks with four 250-watt strip heaters, a shoe manufacturer was enabled to shut down one of the steam boilers during the summer. A considerable saving was made in this way.

The trays that hold the shoes while drying are about 4 feet high and 14 inches wide. The strip heaters were located at the bottom of the trays and a large-mesh wire screen placed about 1 inch above them, to support the shoes. Since a high temperature is not needed, only two heaters are ordinarily used, leaving the two others available when needed.

**5.** Starting the use of electric heat in a small way, a wire and cable plant now uses it almost exclusively, in the operations where heat is required.

Formerly steam was used wherever heat was needed. The first step in breaking away from it came when a few strip heaters were installed in an experimental oven in the lacquering department. Production immediately went up, along with the quality of the work.

Success of this installation led to the mounting of heaters in a tank for melting waxes and compounds used in experimental work. Heaters with a total rating of 12 kilowatts were connected to put 4 kilowatts per phase on the three-phase lines. Three-heat switches controlling these heaters gave nine temperatures, representing more flexibility and a higher temperature when needed than had previously been available.

The next tank converted to electric heat was larger, requiring 18 kilowatts. It is used in melting a heavy compound, and care had to be exercised to avoid hot spots.

With each new installation, additional advantages of electric heat were discovered, with the result that this form of heating is now used for practically every purpose.

**In the plant of The E. W. Rose Company, Cleveland, electric heaters on the container, *A*, of a filling machine, have cut losses in packaging sunburn ointment to almost nothing**

**6.** A manufacturer of bottled beverages experienced difficulty in getting labels to stick. Bottles are filled at a low temperature and pressure, and are rinsed in water after leaving the filling machine. Glue on the labels did not dry rapidly enough or adhere well to the cold surface. As a result the labels were often curled and streaked.

The solution obviously lay in drying and warming the bottles before putting on the labels. How to do this operation was a problem that was eventually solved by building a sheet-iron tunnel 4 feet long over the conveyor that carries the bottles to the labeling machine. A 4-kw. forced-convection-type heater was mounted on the side of the tunnel. It is capable of delivering air at a temperature of 135 degrees Fahrenheit.

Under this blast of warm air the temperature of the bottles is raised about 10 degrees, from 48 to 58 degrees Fahrenheit, while they are passing through the tunnel. By the time they reach the labeling machine the bottles are dry and warm enough for the labels to stick without difficulty. The improvement in appearance was an important advantage, not to mention the saving made by eliminating the need for removing imperfect labels and putting on new ones.

**7.** The proverbial slowness of molasses in January was a costly reality to a manufacturer of stock feeds, composed of a mixture of grain containing a certain amount of old-fashioned molasses. During cold weather production was slowed down, sometimes stopped altogether, because the molasses became so thick it could not be pumped.

Keeping the molasses at a higher temperature was plainly the way out of the difficulty. The problem of how to do so conveniently was solved by wrapping a 60-ft. length of soil-heating cable around the molasses pump and on the pipes leading from the tank and to the mixer. To reduce loss of heat, the cable and pipes were covered with asbestos cement wrapped with muslin tape. Thermostat control was provided to keep the molasses constantly at a suitable temperature.

Total cost of materials for this installation was less than $14. This small sum purchased complete freedom from the troubles formerly experienced. Even when the outside temperature is close to zero there is no difficulty in obtaining free flow of the molasses.

# Used Meter to Pick Power Drives

**Guesswork played no part in the selection of drives in a new building. Load tests and study of schedules showed where group and unit drives were best adapted**

**ELMER J. PRATT**
*Engineer, The Dole Valve Company*
*Chicago*

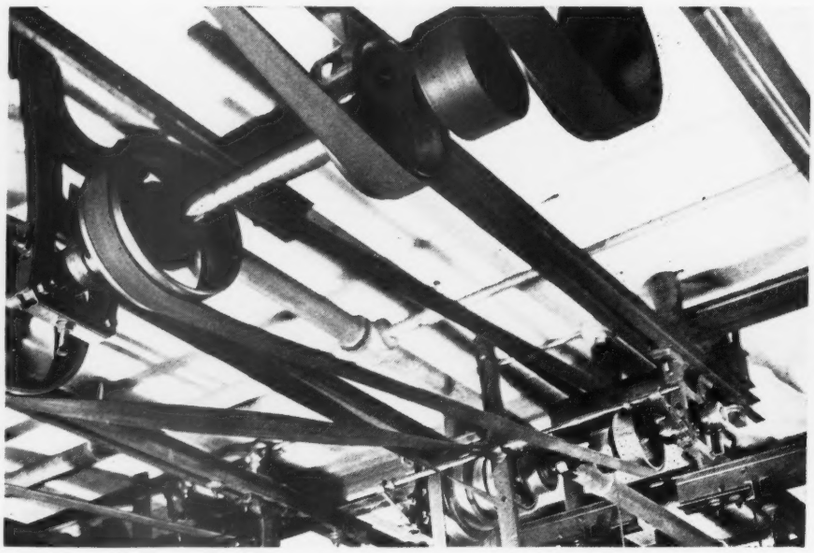
WHEN IT CAME TIME to plan the mechanical power transmission applications in a new building, we decided to get the engineering facts before going ahead and making any decisions. So we put a recording wattmeter on a motor driving our machines individually and by the groups into which they naturally fall in departmental layout. For these tests we used a 20-hp. motor, and moved it from place to place.

What we learned showed us that every advantage lay with group drive for our particular problem. Take, for example, a sizeable hand-screw-machine department. The load on a hand screw machine fluctuates widely. For typical machines we found the requirement for individual drive would be a 3-hp. motor. But tying six of them together with one lineshaft permitted the use of a 7½-hp. motor. Once in a while the meter showed a heavy overload, perhaps up to 12 or 14 horsepower, when all operators happened to reverse simultaneously. But it lasted only for a moment; then the load with all machines running full fell back to less than 7 horsepower.

### Gives Them Better Light

So we went to group drive on our hand screw machines, hand millers, hand drills, and other such equipment in this department. Most of our motors are rated 7½ horsepower, with a few of 5-hp. and a very few of 10-hp. rating on lineshafts driving larger machines. Most of our groupings are in units of six machines. Machines are set at an angle of 12½ degrees to permit close spacing and still let us use bar and rod stock. This arrangement also serves to give better light and permit more machines to benefit by the light from each window. Machines are set for the most part in a row of six, backing up to the next row. Two 7½-hp. motors are used in the typical double row.

An important advantage in original cost came in purchasing the motors. One 7½-hp. motor costs less than double the cost of a 3-hp. motor. Therefore, in place of buying six 3-hp. units, we purchased one of 7½-hp. rating. Thus we saved somewhat more than the cost of four 3-hp. motors per machine line. Cost of the lineshaft and the rest of the drive equipment, installed, did not exceed the cost of mounting and connecting individual motors. Also, there was a substantial saving in the cost of wiring.



**Motors and shafts are hung from inserts set in the concrete ceiling. Stringers and supports were designed to permit changing location of drive equipment with little effort**

While the building was being erected we worked out the plans for machine layout and drives. Flexibility in changing machine location is highly desirable with us, as with most manufacturers. So we had ceiling inserts set in the concrete on 3-ft. centers, which is a much closer spacing than is usual. It has paid liberal dividends, however. The closer spacing permits mounting motors or countershafts with shorter sections of steel; the mounting across three inserts is never longer than a 6-ft. span.

The superstructure for the entire power drive installation consists of steel channels suspended from these ceiling inserts. Each stringer is made of two 5-in. channels bolted back-to-back with ½-in. square head machine bolts, with 1-in. steel spacers between. In erecting, the stringers were first bolted to ceiling inserts, using short lengths of 3-in. pipe above to space them off the ceiling.

Footings for shaft hangers are similarly made of 3-in. channels spaced 1 inch apart.

The advantages of this arrangement will be clear. By loosening a couple of bolts it is possible to move the overhead equipment in either direction along the channel, simply by sliding it. Loosen a couple more bolts and it can be moved at a right angle to the other

direction. Thus, within limits adequate to the probable spacing of machine lines at any future time, we can move any line or single machine and spend no appreciable effort in doing so.

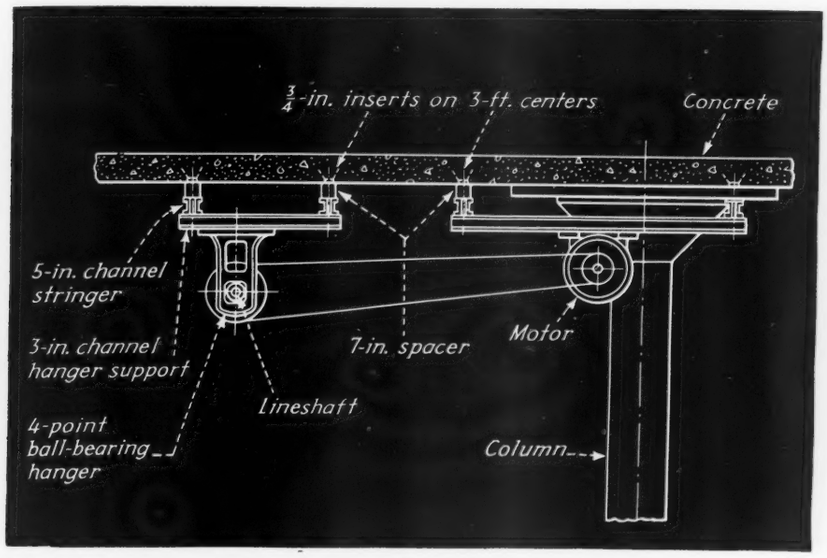
Most of the groups are so set that lineshafts extend down the middle of 24-ft. bays. Two rows of machines are driven off one lineshaft. Except for a row of machines at the end of the room, all lineshafts drive off both sides to countershafts and then to the machines. Each countershaft is driven by a crossed and an open belt drive to pulleys on a duplex clutch.

Anti-friction hanger bearings are used throughout on both countershafts and lineshafts, supported in pressed-steel, four-point hangers. Pulleys are standard split cast-iron and steel pulleys, used with compression couplings which eliminate the need for keying them to the shafts.

Machines are grouped according to the sections that are likely to be used together. Thus at times when the shop is not running at full capacity it is usually a simple matter to schedule the work on machines having unit drives, and cut out the motors which are not needed. It may happen occasionally that a single machine is needed on one line. If this condition is likely to continue for any considerable period, we pull a machine that is not needed out of another line and substitute the machine from the almost idle production line.

It happens that the public service company from which we purchase current does not include a power factor penalty clause in its contracts; therefore, power factor is to this extent less important with us than it would be under other circumstances. Nevertheless we make important savings by loading close to capacity those motors that are in use at any one time. Keeping power factor up avoids excessive voltage drop, or the necessity of using heavier copper. And, of course, our policy of operating a motor either close to capacity or not at all leads to lower maintenance costs because fewer motors are used.

Again, the power rates are based on maximum demand during the winter months. Since we have, typically, a 7½-hp. connected load for our group drives where individual motor drives for the same group of machines would require a connected load of 18 horsepower, this difference is an important factor in keeping power bills down by reducing the demand.




**Details of installation in The Dole Valve Company's new building, showing how motor and shaft are suspended from the concrete ceiling. Most of the motors are 7½-hp. rating**

Before we moved these departments into the new building, we had a combination of group drive and individual drive. We retained individual drive on a few machines in this department for which this type of drive is particularly fitted. Some of our other departments use all individual drives. Our decision to use an individual motor is usually based on the fact that the machine operates on a steady load at close to capacity.

In the old group drives we had our machines arranged in rather large groups driven by one 10-hp. and two 20-hp. motors. The department worked two full-force shifts and one smaller shift. The consequence was that in the extra shift all the motors commonly pulled far less than a full load. With the increased machine capacity obtained by moving into the new department with its additional machines, we eliminated the extra shift and now schedule the work on the machines so that ordinarily a group is either down altogether or on full load.

Lineshafts are driven at 290 revolutions per minute usually by 7½-hp., 220-volt, 60-cycle, three-phase, 1,160-r.p.m. motors. They, too, are mounted on stringers attached to the ceiling inserts, which have proved entirely adequate to handle even this load. Motors and lineshafts are on 9-ft. centers. Ample provision has been made for belt take-up. Center distance between line- and countershafts is 8 feet.

## Under Shock Loads

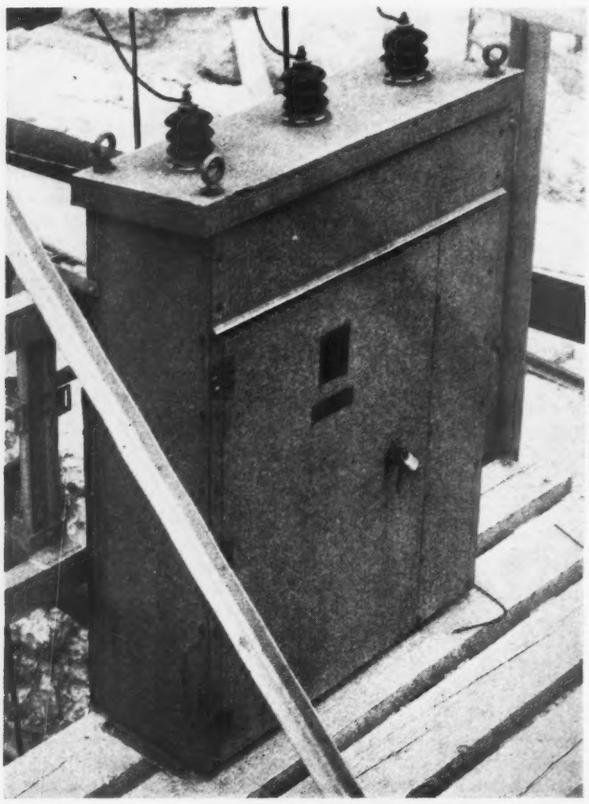
Motor belts are 5-in. heavy double leather. Countershaft belts are 3-in. light double leather, which stand up better under shock loads than would heavy single leather belts, which are theoretically adequate. Belts from countershafts to machines are 2-in. double leather.

Incidentally, when we moved the machines over from the old building to the new one we planned the work in a way that proved to be extremely effective and economical. Lineshafts were erected in advance. Then, when everything was ready, we moved over one machine at a time, as it finished a run. This procedure obviated any interruption of production. Moving was spread out over a longer period than if we had thrown in a force of millwrights and laborers to make the move all at one time, but this method of scheduling permitted handling the work with a small force of men who knew exactly how to do it.

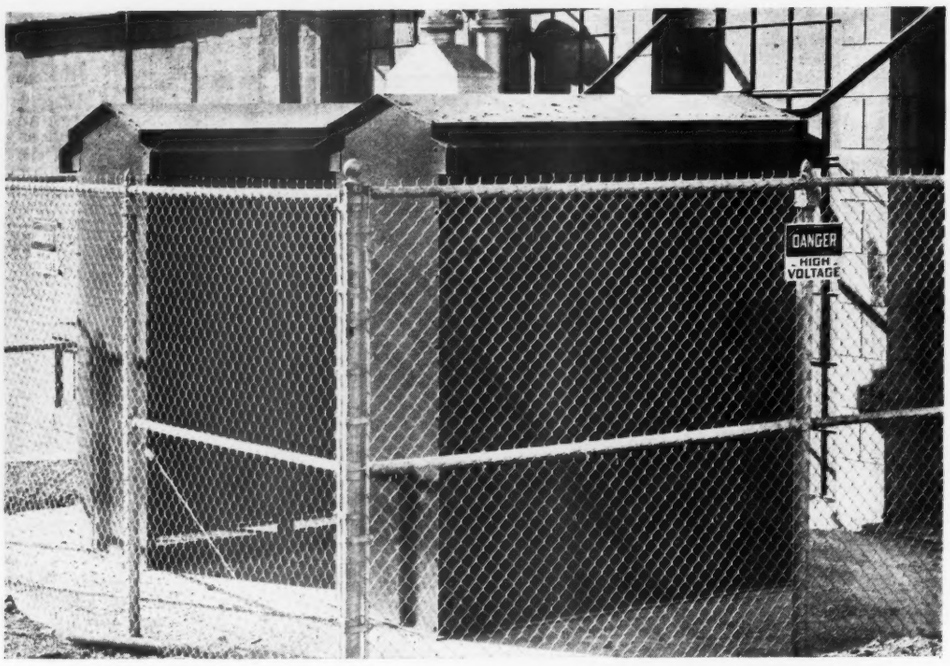
Like most new installations in production departments, the advantages of our group drives cannot be appraised precisely in dollars and cents because there are too many variable factors in the equation. We know that they saved us a substantial sum in the cost of motors and auxiliary equipment, such as starters. They have cut our power bills, both in times of capacity operation and when it is at a lower level. There has been a saving in the cost of wiring as well as in maintenance costs on motors and equipment. Finally, these drives have been completely satisfactory.

# Capacitors Reduce Power Bills

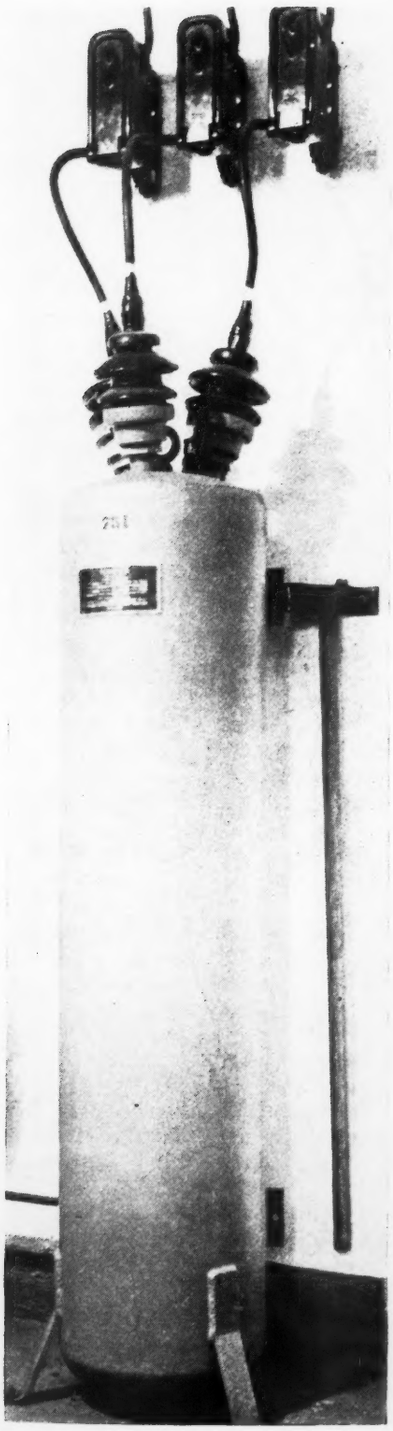
## By raising plant power factor they lower line losses, cut voltage drop



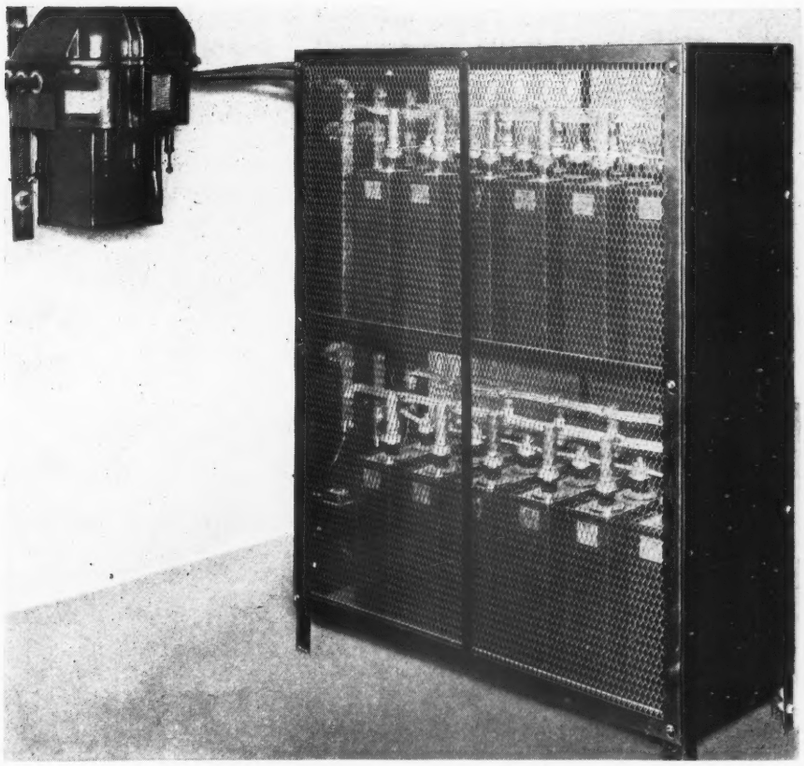
Power bill savings made possible by the installation of this 120-kva., 2,300-volt, 3-phase, 60-cycle capacitor (Cornell-Dubilier) for power factor correction exceeded $413 during the first six months that it was in operation



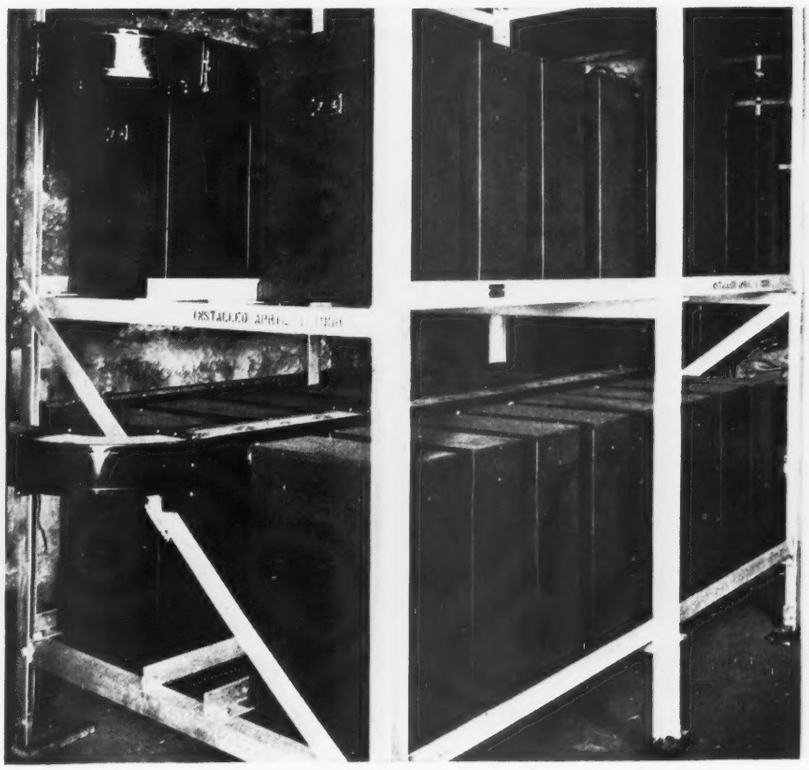

After installing two 2,300-volt units (General Electric) totaling 990 kva., a New York State manufacturer found that power factor improved from 74 to 95 per cent, that monthly savings approximated $525, that the capacitors will pay for themselves in 20 months



Within a year this 45-kva., 4,000-volt Permittor (Entoleter), installed in a vault in a Connecticut plant, paid for itself



Knitting mill installed 180-kva. bank of capacitors (Westinghouse) which will return first cost in 14 months by lowering demand. Better voltage regulation, too, was gained



Forty 440-volt units (United Electric Controls), totaling 600 kva., raised power factor in an Indianapolis plant from 65 to 98 per cent, increased distribution capacity

# Interlocked Controls, Cut Delays

## That's how maintenance solved the important problem of reducing its repair costs and keeping production happy

**J. E. MILLER**

*Assistant Mechanical Superintendent, A. E. Staley Manufacturing Company, Decatur, Ill.*

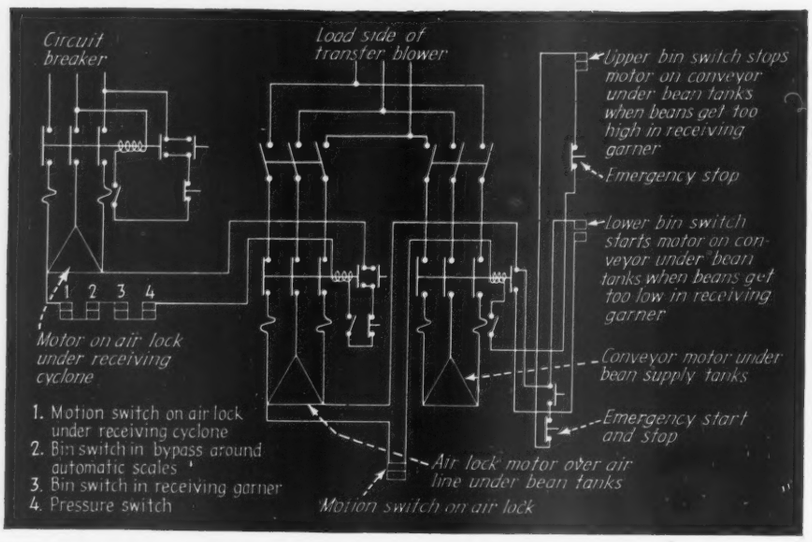
WHEN ANY CONVEYOR, bucket elevator, or other type of continuously operating mechanical handling equipment is delivering steadily into another piece of equipment, there is always a danger of clog-ups, and breakdowns. If the material is not removed as fast as it is delivered, it usually causes damage.

In our experience the least expensive trouble arising from such a situation is that the overload protection cuts out the motor, which merely results in annoyance and a brief interruption. But much more serious troubles can arise. A drive chain may break, gears may strip, a belt burn. Whatever is the weakest point of the equipment gives way, sometimes with very expensive results. If a mass of material piles up in a conveyor and then drops into a process machine as a slug, the whole line may be out of production for quite a while, ruining production schedules.

To the maintenance department the primary interest in safeguarding equipment against such trouble lies in the opportunity to reduce maintenance costs. From the operating standpoint the matter may be of even greater significance. Consider a point where close watching is needed to maintain optimum conditions as, for example, a storage bin where the material runs in at the top and flows out at the bottom. This bin, let us say, is a safety element providing slack in the process: It guarantees a supply of material that can be used when some minor interruption halts the normal flow.

What the operating department requires here is that the bin be full at all times—not half full, and not overflowing, but right up to the top level to give, let us assume, an hour's supply of raw material. If the flow of material to this bin is to be controlled manually a man must be detailed to watch it.

It was to guard against the needless expense of having a man standing by doing nothing but watch a process, or the alternative of having things go wrong because precautions are not taken by a man elsewhere engaged, that we began putting under automatic interlocking control protection many of the key operations in our plant. We experimented for a while and soon arrived at a number of rules-of-thumb which might be dignified under the name of basic principles. Of these, the most important is: Make everything fully automatic.


Circuit breaker
Load side of transfer blower
Upper bin switch stops motor on conveyor under bean tanks when beans get too high in receiving garner
Emergency stop
Lower bin switch starts motor on conveyor under bean tanks when beans get too low in receiving garner
1 2 3 4
Motor on air lock under receiving cyclone
Conveyor motor under bean supply tanks
Emergency start and stop
Air lock motor over air line under bean tanks
Motion switch on air lock
1. Motion switch on air lock under receiving cyclone
2. Bin switch in bypass around automatic scales
3. Bin switch in receiving garner
4. Pressure switch

**How screw conveyor motor control is interlocked with controls of other equipment that takes beans from cleaner and through storage to process. For simplicity, connections for transferring interlocks from conveyor motor to bucket elevator are not shown here**

### There Must Be Storage Capacity

To describe all of our interlocking controls would require a sizeable book. The principles nevertheless which we have found valuable both from a maintenance and an operating standpoint can be adequately brought out by describing in detail some of the highlights of a couple of typical interlocking control systems in two of our departments.

The process taking place in this major division of our plant involves converting beans, which arrive by freight car, into oil and stock feed. The process is basically one of milling and extracting, with a tremendous amount of mechanical handling from process to process.

Practically the entire flow from the time the beans leave the freight car is controlled automatically. But the controls are divided sectionally, for convenience both in safeguarding and in operating. Operating divisions or logic have no share in our control divisions. What we must have is material coming from a storage place and going to a storage place. Lacking this storage capacity at each end of the control system, the plan simply could not be made to work.

The first division handles the unloading of the beans from cars into storage

tanks and transferring them from storage tanks to a processing bin (known as a garner) which holds an hour's supply of beans for the entire plant. In other words, if the supply of material from other sources is completely shut off, we can run for an hour on the contents of the garner.

Cars are unloaded by power shovels into a pit, and the beans are then taken from the pit to a cleaner by bucket elevator. From the cleaner they are transferred by an air line carrying positive pressure of medium strength to the storage tanks, into which they are discharged at the top. A screw conveyor delivers them from the storage tanks to another air line leading to the garner.

There are, however, two other possible routes for the material to take. The air line which normally delivers the material from the cleaner into the top of the storage tanks may be extended by throwing a valve so that the beans go directly to the garner. This arrangement permits sending beans from the cleaner directly to process, instead of into storage.

The second of these alternative routes can be brought into use by throwing a valve underneath the cleaner, so that the beans are delivered into the air line which normally takes them from the screw conveyor. Thus again we bypass the storage tanks.

CAUTION
BECAUSE OF REMOTE CONTROL BE SURE TO DISCONNECT CIRCUIT BREAKER AND PUT ON WARNING TAG BEFORE WORKING ON THIS EQUIPMENT

**The author takes a look at interlocking connections on the conveyor motor control**

## Two Kinds of Controls

There are two sets of controls for this equipment. The first set is purely protective and of major interest to maintenance. It includes the normal overload protection for motors, a pressure switch which protects against excessive pressure in the air line (which can come either from a choked-up air line or from too much material being fed into the air line) and motion switches attached to the feeder valves feeding into and delivering from the air line. Also, there is a bypass spout around the automatic scales which will automatically bypass them if material piles up here. It acts on a paddle switch which bypasses the scales, shuts off the flow of material, and blows a horn. At the top of the garner, there is another paddle switch to do the same important job.

All of the protective equipment does the same thing: Whenever anything goes wrong, the screw conveyor automatically shuts down and a horn squawks to call attention. A shut-off is placed in the horn circuits, with a relay that restores the horn to service as soon as conditions are normal.

In addition to the protective controls we have operating controls. A level control near the top of the garner stops the screw conveyor when the upper level is reached, starts it again when the level drops 6 inches. There is another level control 18 inches below the upper one, which turns on a light and blows a horn in the processing building to warn the operator that the bean supply has failed.

As has been explained, the control equipment normally governs the screw conveyor that takes material out of the storage tanks. But when we find it necessary to take material directly from the cars to the garner, we change a valve. This shifts the flow of material, and also shifts the controls so that instead of governing the screw conveyor they govern the bucket elevator, according to the level in the garner.

In the finishing section our controls work differently, but just as effectively. The process starts with the three grinding mills where the cake is ground to meal. Cake is delivered to each mill through a feeder valve driven by a variable-speed transmission so that the load can be properly distributed among the three mills.

## No Alarm Needed

All of the control equipment in this finishing section is for protection rather than operating purposes. It acts through the motors on the three feeder valves. If anything goes wrong in this section, the flow into the mill is stopped and the material bypassing the mill flows out onto the floor. No other type of signal is needed because the operators will notice the overflow. The material has to be shoveled off the floor, and the men dislike the job.

Protection against stoppage here is an air flow switch. The switch is installed in the bottom of the cyclone where there is a negative pressure. There are three cyclones serving the three mills. Each switch shuts off the feed to its own mill, so that instead of dumping the entire production on the floor, we dump only one-third.

## Maintenance Cheaper Than Repairs

Meal is taken from the three cyclones by a series of drag conveyors to reels where it is sifted and the finished size is dropped into storage bins. Motion switches on the reel drive and on the conveyors shut off the feeder valves to the mills in the event of failure. Wherever failure occurs the controls are devised so that they shut down the preceding, but not the succeeding, operations.

From the maintenance standpoint we now have, of course, a lot of control mechanisms to maintain where previously there were none. But despite the volume of work that this brings, the total maintenance expense in the departments is far below what it was formerly. You can take meticulous care of a great many controls for what it costs to tear up just one line of conveyor—not to mention the savings that come from reducing interruptions to production.

# MAINTENANCE SERVICE SHORTS

**Readers are invited to contribute brief illustrated articles reporting out-of-the-ordinary maintenance accomplishments. Accepted articles will be paid for**

## POWER AND LIGHT

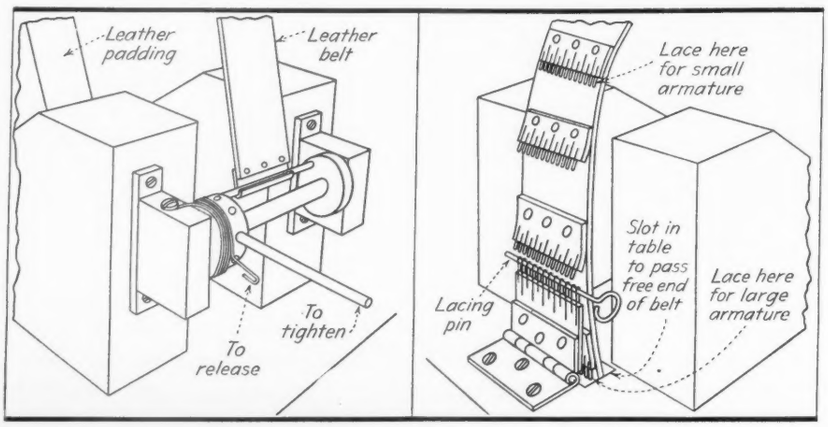
### Armature Holder Speeds Assembly of Ball Bearings

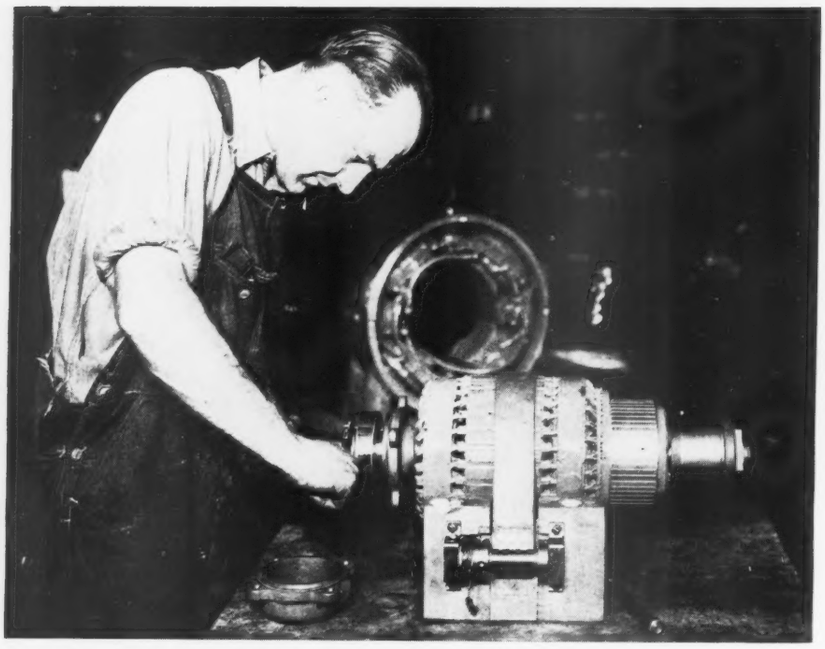
J. H. YEAGER, *Methods Department The Reliance Electric & Engineering Company, Cleveland*

After the winding of a d.c. armature has been completed and the unit dynamically balanced, it is highly important to limit further handling as much as possible. Even slight bumps may be sufficient to injure a commutator face, damage the insulation, or change the shape of a coil head enough to affect the balance of the armature.

Assembling ball bearings on armature shafts, for example, is an operation which involves the possibility of inflicting one or more of the foregoing injuries. It is difficult to keep an armature of any appreciable size from rolling while the locknuts for the ball bearings are being tightened.

A satisfactory solution to this problem has been found in the development of a holder capable of handling armatures ranging from 7¾ to 13 inches in diameter. As the illustrations show, this device consists of two V-blocks padded with leather and an adjustable-length leather belt which is held taut by a spring clutch. The length of the belt



**Secured in the holder, the armature cannot be damaged while bearings are assembled**

can be changed by moving its free end forward or back the desired amount and locking it with a steel rod inserted in the proper set of belt lacings with which the belt is provided. The clutch wraps a spring around itself in holding down the armature, and is released by lifting the free end of the spring in the direction of unwrapping it.

After the bearings have been mounted and locked on the shaft the armature remains strapped in the holder while the latter, which is permanently attached to a dolly, is moved to the point in the assembly line where the armature is put in the motor frame. By handling the armature in this way a further source of possible injury to the armature is avoided.

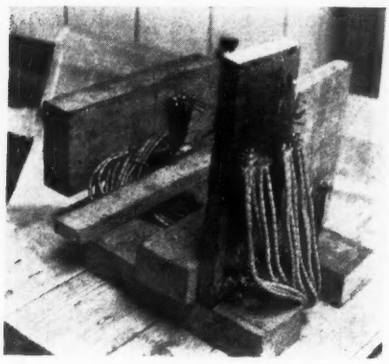
This method of holding armatures has proved to be entirely satisfactory and has also served to reduce materially the time formerly required to complete the assembly of the ball bearings on the shaft.

## Wooden Model Helped in Making Cable Layout

L. A. HUNT, *Service Engineer*
*Bepco Canada Limited, Montreal*

When planning the installation of a 750-kw. rotary converter we considered running the cables between the machine and the switchboard in a tile duct laid in the floor. Investigation revealed, however, that it was not feasible to cut the floor away and lay the duct in it. There was too little room in the machine pit and behind the switchboard to permit the heavy cables to take their natural curve.

Then we considered closing off the space between two steel beams below the floor and using the duct formed in



this way, but there was some question as to whether the required number of cables could be accommodated. Space was limited, especially where the cables had to clear a cross-beam just below the rotary's bedplate.

To avoid guesswork a rough wooden model was made to scale, nails being used to indicate the location of the terminals behind the switchboard and at the machine. The scale for the model was chosen so that No. 12 r.c.d.b. wire could represent 1,500,000-circ. mil cables and No. 14 r.c.s.b. wire, 1,100,000-circ. mil cables. There were two cables in parallel per terminal on the a.c. end, and three on the d.c. end. Wires corresponding to these cables were fitted into the model, being given a radius at the corners equivalent to that which the heavy cables would take.

It was seen from the model that the cables would go into the ducts provided, but would be rather crowded near the machine, and that sharp bends would be required behind the switchboard.

After constructing the ducts the cables were installed, and the completed job turned out exactly as expected. In addition to saving the cost of larger ducts, which drawings had shown might be required, a further saving resulted from the fact that practically the exact length of cable required was ordered, so that long scrap ends were avoided. This was accomplished by removing the wires from the model, straightening them out, and taking scale measurements of the lengths. The actual cable lengths used were within 2 per cent of the scaled lengths.

# MAINTENANCE SERVICES

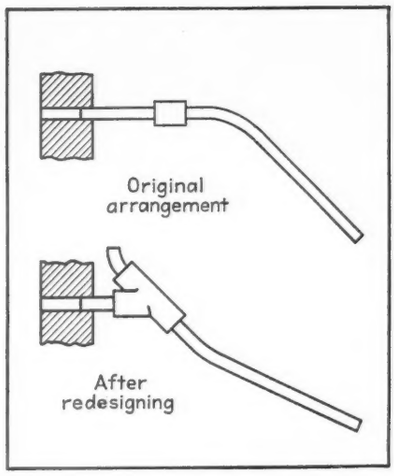
## Oil Lead Change Improves Engine Lubrication

ELTON STERRETT, *Longview, Tex.*

In a plant which generates its power with internal combustion engines, frequent shutdowns were charged on the weekly report to clogged sight-feeds.

Frequency with which this item appeared led to an investigation. As a result the layout of the oil lead, made of $\frac{3}{8}$-in. pipe, from sight-feed glasses outside the engine base to the main bearings was found to be at fault.

The manufacturer's design called for a 4-in. long right-and-left nipple screwed into the engine base, with a coupling or collar screwed into the projecting, left-hand, thread of the nipple. Into it was screwed a curved section which carried lubricant down into a distributor pocket atop each main bearing. As shown in the sketch, the oil had a horizontal flow of 8 inches or more before the down-drop section began. In this long horizontal section any carbon or other sediment which had escaped the oil filter had an opportunity to settle out, gradually clogging the line so that manual cleaning was required.




In the redesigned oil feed a close nipple, a Y-branch, and a sweeping curved section were used to reach the bearings. As a further improvement a short vent line was put in the upper run of the branch.

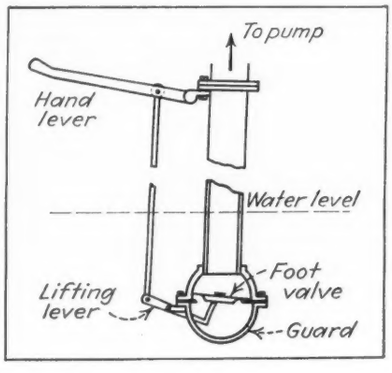
After this change the oil leads immediately came off the log as a cause of shutdowns, and sight-feeds no longer required the undivided attention of the men in charge.

# BUILDINGS AND SERVICES

## Lever Used to Clear Pump Foot Valve

K. B. HUMPHREY, *Sayreville, N. J.*

When a centrifugal pump is used for draining pits and doing other odd jobs, common practice is to equip it with a foot-valve and depend on a bucket to supply priming water. Use of a foot valve sometimes leads to trouble, because any small object lodged under the valve will cause loss of priming when the pump is stopped. During cold weather when the pump is used only in the daytime it is necessary to drain the whole line, and then a perfect-fitting foot valve is difficult to open.




A simple way out of these difficulties is to use a lever arranged so that the valve can be operated from above, as shown in the sketch. Addition of the hand lever at the top will make operation easier. With most foot valves it is possible by the use of a slightly longer bolt in one of the holes to provide a satisfactory pivot for the lower lever. The shape of the lever where it hits the valve will have to be made so that it will clear the usual cast-iron cage or screen, and hit the valve where no harm can be done.

The ordinary leather valve, shown in the sketch, has a piece of cast iron bolted to it in the middle. If a small

piece of wood, say, lodges under the valve when the pump stops it may be impossible to fill the pump and get it started before the priming water leaks out. By supplying priming water as fast as possible and at the same time working the valve by means of the lever, the piece of wood usually will be washed away so that the valve will shut. It will then be easy to prime the pump.

When a hose is used for a suction line, it is not practicable to apply a lever, although frequently the hose is light enough so that one man can pull up the foot valve to inspect and clear it. One disadvantage, however, is that the valve lies flat and if there is a chance of its sticking it will not be noticed. If the valve is held in a horizontal position with the hose vertical it is possible to use a hooked rod to work the valve. This should be done while priming water is being added, in order to clear the valve as quickly as possible and at the same time provide pressure to seat it properly.

•

**Because steam lines may be broken by falling structures during fires, they should be controlled by valves on the boiler header, so that damaged lines can be cut off and the boilers kept going to run the pumps.**

•

## Physicians' Instruments Help a Maintenance Man

BERNARD GOLDEN, *New York*

The linotype mechanic in a certain newspaper plant uses to good advantage some instruments that are more commonly associated with physicians and dentists than with maintenance men. These instruments include a stethoscope, hypodermic needle, dental mirror, and rubber gloves.

The stethoscope is used to determine the condition of impregnated fabric pinions. Life of a pinion is usually several months, but eventually they wear to the point where jamming occurs. When the stethoscope is placed on the end of the motor shaft it picks up the sound of the gear and pinion. A clear, whirring sound is produced if they are meshing properly and are not noticeably worn. Clashing or grinding noises indicate excessive wear. Long experience has made it possible for him to estimate with considerable accuracy about when failure of the pinion may be expected. Of course, a new one is put on before the failure.

Putting a very small drop of oil on the keyboard cams is the function of the hypodermic needle, which is all steel, with a gold tip. It is the most convenient means which this mechanic has found for getting just the right amount of oil in the right place.

The dental mirror is used when inspecting parts that are not readily accessible, or easily seen. It is used, in particular, to determine the condition of a fiber washer which has to be replaced frequently. Without the mirror it would be difficult or impossible to tell when the washer should be replaced, before failure.

He wears the rubber gloves when handling micrometers and other delicate tools and parts which are likely to be damaged by the small amounts of acid which his hands often pick up.

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## Reflectors Make Tank Gage Target Readable at Night

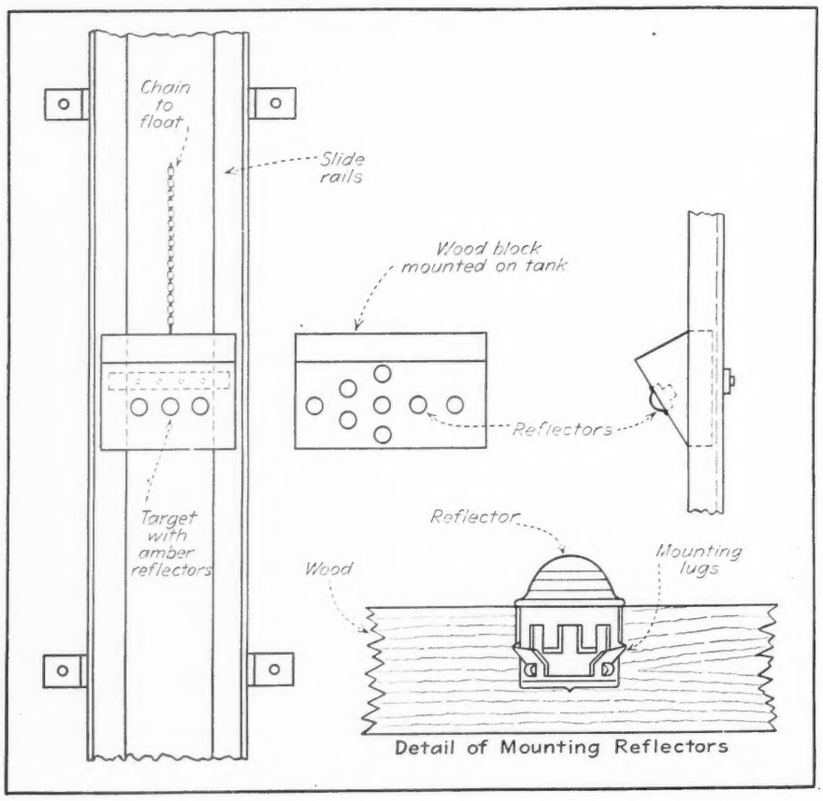
K. N. BANTHIN, *Oak Park, Ill.*

While changing over a process plant from plant-generated d.c. power to purchased a.c. power, it was necessary that the night watchman manually control the operation of the deep well pump used to fill the elevated service water tank. In the first few days of manual operation the tank ran over twice and was under-filled once. The watchman, when questioned, revealed that he could not at all times see the gage target with the beam of his focusing flashlight. The duration of the changeover, however, did not warrant the installation of electric lights along the gage board.

To remedy the condition quickly and cheaply a new wood target block with three 1-in. amber-colored reflectors was constructed to replace the existing gage target. On the sides of the tank, at the full, midway, and empty positions, other blocks were attached, each having eight of the 1-in. reflectors mounted in the pattern of an arrow. At the full position the arrows were made of amber reflectors, green at midway, and red at empty.

The reflectors were mounted in the wood block by a special flared clip furnished by the manufacturer. This clip is attached securely to the mounting lugs on the rear of the reflector unit housing and vibration or any attempt to withdraw the reflectors only causes the clip to expand and dig into the wood.

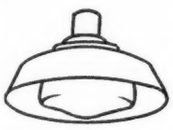
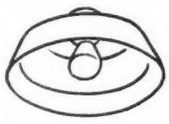
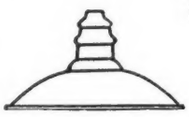
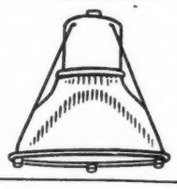
This reflector target provided a readily visible indication of the water level when the beam of a focusing flashlight was flashed on it, even on the rainiest nights. Materials and labor for the installation cost $13.30, one-quarter of what the electrical department estimated electric lights would cost.



Detail of Mounting Reflectors

# Reflectors for Plant Lighting

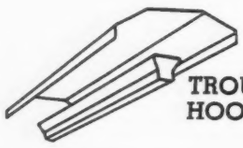
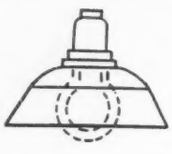
## Typical Designs for Everyday Needs

| | |
|---|---|
| **RLM DOME** | Gives wide, even distribution of light over both horizontal and vertical surfaces. In dusty locations, a glass cover plate can be included to keep reflecting surface clean. |
|  **GLASSTEEL DIFFUSER** | Used where softer, better diffused light than that provided by RLM Dome is wanted. Particularly effective where small shiny parts are handled. Aperture in top allows small amount of light to illuminate ceiling, kill shadows. |
|  **SILVERED BOWL DIFFUSER** | Combines easy maintenance of RLM Dome with low brightness of Glassteel Diffuser. Consists of semi-diffusing aluminum insert in porcelain-enameled reflector, used in conjunction with silvered-bowl lamp. |
|  **SHALLOW DOME** | Spreads light over a wide area where glare from lamp is not objectionable, as in storage spaces. |
|  **PRISMATIC GLASS** | Prismatic construction permits control of light distribution. Low-bay unit shown gives intensive distribution; similar units provide focusing and widespread distribution, respectively. Smooth inner surface of reflector facilitates cleaning. |
| **HIGH BAY** | Light is directed strongly downward from high mounting in concentrated distribution on horizontal surfaces. |
| **ANGLE** | Symmetrical and elliptical angle reflectors provide general illumination in areas that cannot be adequately lighted from overhead, such as crane bays. Also adapted for assembly lines and spray booths where local illumination is needed from the side and on vertical planes. |

CONCLUDED ON FOLLOWING PAGE

# Reflectors for Plant Lighting

CONTINUED FROM PRECEDING PAGE

| | |
|---|---|
| **MERCURY** | High levels of general illumination from mercury lamps are possible with this reflector. |
| **COMBINATION MERCURY-INCANDESCENT** | Dome and diffuser types for combining mercury and incandescent lamps where daylight is to be simulated. |
| **BEAM DIRECTORS** | Auxiliary projector, attached inside skirt of RLM Dome, directs beam of light from unit of the general lighting system, for local illumination. |
| **DEEP BOWL** | Light is directed strongly downward for high-intensity local lighting. |
| **INTENSIFIERS AND SPOTLIGHTS** | Louvered or glass-covered reflectors afford directional, high-intensity illumination for inspection and machine operations. Can be adjusted to send light in any direction. |
|  **TROUGHS AND HOODS** | Provide diffused illumination of low surface brightness for inspection, drafting, and bench operations. Use of incandescent, mercury, daylight, or fluorescent lamps, and different types of color-correcting glass, make this general type of reflector adaptable to wide variety of special requirements. |
| **BIN** | Designed to provide uniform illumination of shelf tiers from top to bottom, throwing light into bins. |
|  **VAPOR-PROOF** | Construction prevents flammable or corrosive dusts and vapors from reaching lamp and socket. |

# A permanent "GO" signal for material handling *with* the Exide System

THE EXIDE SYSTEM now makes fully effective all the speedy performance and unfailing dependability of Exide-Ironclad Batteries for material handling . . . bringing you faster, more continuous service at minimum cost.

It does this by providing the most efficient size and type of Exide-Ironclad for your trucking job, and by insuring proper care for that battery through equipment almost wholly automatic.

The Exide System starts with instruments that scientifically determine the right Exide-Ironclad for your needs. It provides the Exide Discharge Indicator which mounts on your truck, avoiding delays and tow-ins by flashing a visual warning as the battery nears discharge. It also provides the Exide Charge Control Unit which mounts on your charging panel, automatically controlling the rate of charge, then cutting the circuit and flashing a signal when the charge is complete.

This Exide efficiency equipment is moderate in cost. Why not write for full details?

Exide
IRONCLAD
BATTERIES
With Exide MIPOR Separators
"MIPOR," Reg. U. S. Pat. Off.

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia

*The World's Largest Manufacturers of Storage Batteries for Every Purpose*

Exide Batteries of Canada, Limited, Toronto

# You Want to Know

**more about the items mentioned on this page.**
**Letters to the addresses given will bring information**

• MAINTENANCE MEN can widen their acquaintance with rust-inhibitive paint by reading a booklet "Improved Maintenance of Metal Surfaces with Zinc Dust Paints." The New Jersey Zinc Co., 160 Front St., New York.

• SET of precision measuring standards consists of nine standards claimed to be accurate to 8 millionths of an inch. Furnished with them is an optical parallel accurate in planeness within 4 millionths. George Scherr Co., Inc., 128 Lafayette St., New York.

• RACK COATING MATERIAL, said not to blister or crack, and to contain no ingredients harmful to plating baths, is not affected by boiling cleaners or plating solutions in general use. If structural changes in the rack must be made, uncovered sections can be protected without recoating the whole rack. United Chromium, Inc., 51 East 42d St., New York.

**SMALL PARTS keep their places on this 30-compartment, ferris-wheel-like parts rack. Used on the bench, or fastened to a wall, its convenient trays hold assembly stock, shipping supplies, or maintenance parts. Diagraph-Bradley Stencil Machine Corp., 3745 Forest Park Blvd., St. Louis.**

• PORTABLE TOOLS for driving studs, punching holes, bonding pipe, tightening or removing rivets, and cutting steel cable, operate by detonation of special blank cartridges. Made of stainless steel, the tools can be operated under water. Mine Safety Appliances Co., Braddock, Thomas, and Meade Sts., Pittsburgh.

• RESPIRATOR protects wearer from metal fumes. Has rubber face mask and easily cleaned filter. Willson Products, Inc., 242 Thorn St., Reading, Pa.

• SPEEDS AND FEEDS to use in cutting steel, cast iron, non-ferrous metals, and non-metallic materials with cemented carbide tools are conveniently tabulated in a bulletin. Grades of cutting metal recommended for different materials and a method for determining power requirements are included. Carboloy Co., Inc., Detroit.

• SYMPOSIUM on the Wage and Hour Law contains twelve articles critically treating the law in all its aspects. Questions concerning its legal interpretation and economic effect are discussed. 75c. per copy. "Law and Contemporary Problems," Duke University School of Law, Durham, N. C.

• "GALV-A-NIEL" prepares galvanized metal for painting, cleaning the metal of ordinary dirt and building up a surface film that produces a bond for the paint. Single dipping, brushing, or spraying application. Mar-Nel Chemicals, Redford Station, Detroit.

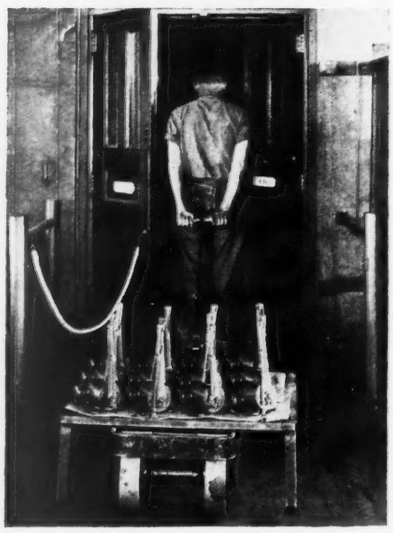
• MORE PEOPLE are employed making, transporting, installing, and maintaining machinery than are displaced at the point of machine use, says an analysis of the theory of technological unemployment. Copies of "Machinery's Part in Future Social Progress" can be obtained from Farrel-Birmingham Co., Inc., Ansonia, Conn.

• RUBBER MOLDS for white metal castings are part of a process that makes possible duplication of any item from a metal model, within the space of a few hours. Castings of fine detail and smooth texture are produced, it is said. Alrose Chemical Co., Providence, R. I.

• CORROSIVE CONDITIONS are home to a liquid coating that protects metal, concrete, or wood from atmospheric corrosion, salt air and water, acids and fumes, and alkalis. Corrosion Control Corp., 212 Wright St., Newark, N. J.

• THREE BIBLIOGRAPHIES of books holding interest for plant men have come along in the past month: "A Reading List on Business Administration" (revised as of June 1), 30c., The Amos Tuck School, Dartmouth College, Hanover, N. H.; "Selected Books on Business" (as of February, 1939), 50c., Extension Division, University of Nebraska, Lincoln, Neb.; "Recent Books of Interest to the Industrial Relations Executive," 10c., Industrial Relations Section, Princeton University, Princeton, N. J.

• X-RAY RESEARCH to determine relative medical and economic merits of available x-ray methods for making physical examinations of employees has resulted in a report, "The Comparative Value of Chest Roentgenograms Made on Film and on Paper for Industrial Surveys." $2 per copy. Air Hygiene Foundation of America, Inc., 4400 Fifth Ave., Pittsburgh.



**"THE PHANTOM DOORMAN" makes the trucker's task easier, prevents damage to doors, and if there is air conditioning, keeps load on the conditioning equipment down. Hydraulic pressure mechanism, controlled by photoelectric equipment, is the thing that does the trick. The Yale & Towne Mfg. Co., Stamford, Conn.**

• ENAMEL, applied to any polished metal, makes that metal resemble brass, chemically treated aluminum and steel, and other colored metals. A baking enamel, it resists action of cleaning operations and plating baths. Maas & Waldstein Co., 438 Riverside Ave., Newark, N. J.

• THREE MANUALS for department heads and foremen, on the Wagner, Walsh-Healey and Wages and Hours acts, explain the significance and intricacies of these all-important acts to industry's key men. 50c. per copy; $1.20 per set of three. National Foremen's Institute, Inc., 60 East 42d St., New York.

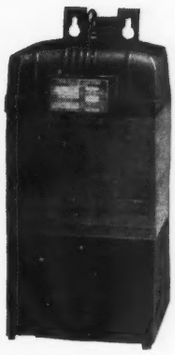
• DR. VICTOR G. HEISER, in his article on industrial health problems in the May FACTORY pointed out the need for exercising great care in conducting physical examinations of employees. The Industrial Commission of Wisconsin is putting this idea into practice by issuing a list of recommendations, reprinted in booklet form by the Employers Mutual Liability Insurance Co., Wausau, Wis.

# How to do it?

## Every one of these electric devices may quickly pay for itself in your plant

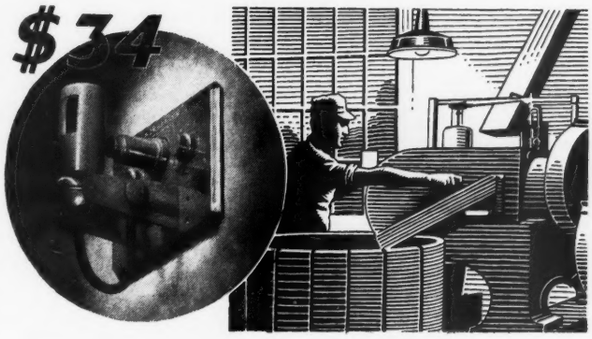
### IMPROVE YOUR POWER-FACTOR

If your power contract includes a power-factor adjustment or kva-demand clause, you may be able to make substantial savings by installing G-E power-factor-improvement equipment. Hundreds of industrials have installed G-E Pyranol capacitors for this purpose. Ask us for Publication GEA-2742.



### INCREASE CIRCUIT CAPACITY QUICKLY AND INEXPENSIVELY

With these new air-cooled transformers, power voltages can be stepped down, for lighting or low-voltage power loads—at any point in your plant. They offer many advantages, such as reduced losses better voltage, etc. Let us send you our new Publication GEA-897H.




### USE YOUR LIGHTS EFFICIENTLY WITH G-E AUTOMATIC LIGHT CONTROL

G-E automatic light control (which makes use of the "electric eye") provides efficient use of your electric lights by automatically turning them on only when they are needed—and by turning them off when they are not needed. Your workers will have light to work by when it is needed, yet unnecessary use of lights will be eliminated. Price, complete with 30-amp contactor, $34. For further information, ask for GEA-2679.

### NEW RECORDING INSTRUMENT SIMPLIFIES SURVEY WORK

You've never seen a recording instrument quite like this. It weighs only 11 pounds. Uses no liquid ink; therefore there's nothing to freeze or spill and thus spoil the record. Use it indoors or out. The most recent addition to General Electric's complete line of electric instruments. Send coupon for Bulletin GEA-3187.

General Electric, Dept. 6H
Schenectady, N. Y.

I should like to have more information on the products checked. New automatic light control, GEA-2679 ☐ . . . . New inkless recorder, GEA-3187 ☐ . . . . Power-factor improvement capacitors, GEA-2742 ☐ . . . . Air-cooled transformers, GEA-897H ☐ . . . .

Name.....

Address..... State.....

City..... 96-574

# GENERAL ELECTRIC

SEE THE G-E "HOUSE OF MAGIC" AT BOTH FAIRS

# What's New in Equipment

### Impact Mountings

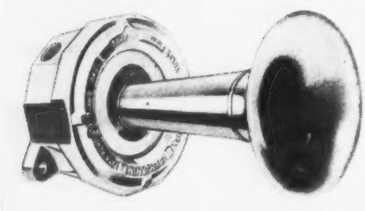
Shock impact mountings, for installation on idlers at points of impact in loading, are designed to permit belt idler and frame to recoil from impact, the recoil being absorbed by movement of the rubber in the mounting. Because the rubber is in shear it distorts easily, it is claimed. Four mountings are used on each idler frame and are fastened through the angle-iron base of the mounting to the conveyor "stringer." For mounting, the metal face bar of the mountings is tapped and equipped with ½-in.-diameter S.A.E. heat-treated cap screws. For protection of the rubber against oil, a metal shield can be inserted between the idler channel and face bar. Size of mounting varies with amount of impact and width of belt—4-in. mounting for light impact, 6- and 8-in. mountings for more severe impacts on belts 48-60 in. wide. Mechanical Rubber Goods Div., The B. F. Goodrich Co., Akron.

### Double-Throw Switches

Unfused Type A double-throw switches have quick make-and-break, cover interlock, and padlocking divisions for three padlocks in the "off" and both "on" positions. V-type blade and multi-spring jaws. Sizes: 60, 100, and 200 amp., two- and three-pole. All sizes are available for either 230-volt or 575-volt a.c., as well as 250-volt d.c. Square D Co., Detroit.

### Signals

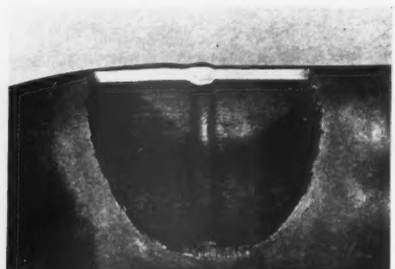
"Howler" line of signals features distinctive tone, high volume, and simple assembly. Great sound penetration is claimed because of the distinctive tone. Simply turning a threaded ring detaches



the signal from its base. The entire assembly plugs into base socket in much the same way as any ordinary appliance plugs into a wall outlet. This interchangeable plug-in feature assures easy replacement when needed, and facilitates inspection and service work. There are both weatherproof and non-weatherproof types, the latter including ½-in. knockouts for conduit entrance and mounting holes for attachment to standard outlet boxes. Both types are available in single and double projector models. Benjamin Electric Mfg. Co., Des Plaines, Ill.

### Welding Fitting

"Centring Weldells" are a seamless forged steel welding fitting whose outstanding feature is its annular lip, which is forged integral with the fitting. By firmly centering the fitting in the pipe to which it is to be welded, the lip elim-



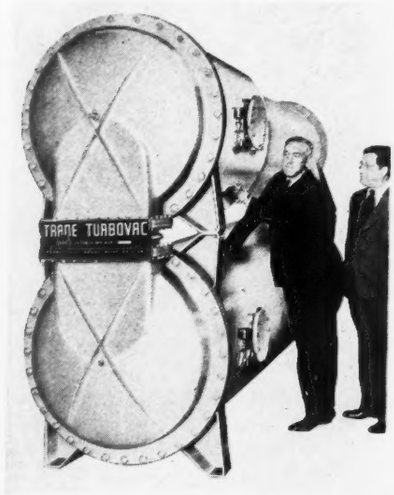
inates the need for backing rings, clamps, and guides for holding the fitting in position. The fitting is of full pipe thickness throughout with reinforcement in zones where greatest stress occurs. Tangents, machine-tool bevels, ends marked in quarter sections, and name, size and weight are rolled into each fitting for quick and easy identification. The annular lip remains cooler during welding than the molten weld material, and as a result, the bottom of the welding V appears darker than the sides. This color contrast guides the welder, permitting him to obtain complete penetration without burning through. Taylor Forge & Pipe Works, P. O. Box 485, Chicago.

### Carboy Pourer

Safety carboy pourer is intended for handling aluminum carboys. With carboy resting on its base, the pourer is placed over the top and clamped securely by means of a threaded handle just below the shoulder. An easy pull on the handle brings carboy over into pouring position, resting on a broad rocker base. Pulling the pourer still further until it rests on the handle permits complete drainage of carboy. Lewis-Shepard Sales Corp., 245 Walnut St., Watertown, Mass.

### Air Conditioning Unit

The "Turbovac" incorporates all the




mechanical essentials for the provision of chilled water for air conditioning. Installation calls for only the necessary water connections and power hook-up. It is a hermetically sealed low-pressure water chiller containing within a heavy steel casing a centrifugal compressor using a refrigerant of the Freon family, a water chilling unit, and a condenser. The motors are also inside the unit. The motor rotors are the only moving parts. Available at present in one size with capacity ranges from 65 to 80 tons. Unit measures approximately 11½ ft. long, 8 ft. high, and 4 ft. wide. Impellers are fabricated of nonferrous metal to prevent corrosion and subsequent unbalance. The Trane Co., La Crosse, Wis.

### Block and Chain

The "Liftug" is a tool that may be adapted for binding loads on trucks, skidding machinery, lifting loads, stretching fence and cable, and many other uses. Power on the lever is transmitted directly to the chain. The lever, chain, and sprocket move through their respective arcs of travel without friction upon each other. Two pawls function directly upon the chain, catching each link and lifting and

# SMALL IN SIZE....LOW IN COST....BUT...

# BIG IN MONEY SAVING PERFORMANCE!

## Engineering Achievements in Allis-Chalmers SSUnit Pumps Give Plants All Over the Country Extra Dollar-Saving Pumping Performance!

Meet a money-saving performer . . . that's what we asked plant managers all over the country to do in 1926 when our engineers — the same ones who designed and built the gigantic Boulder Dam and Niagara Falls Turbines — originated the SSUnit pump!

For we knew that we had a pump that would revolutionize pumping practice . . . actually in one stroke do away with old, money-wasting pumping methods!

### SSUnits Set Pace!

And the fast-selling SSUnit Pump . . . new in performance and extra value features still sets the pace today!

It's outstanding for its simple, compact, husky design that beats space waste . . . sends maintenance costs to a new low! The enclosed runner, wearing rings and shaft sleeves are made of bronze . . . no chance for rust or excessive wear! Complete testing before delivery is your assurance that your SSUnit Pump can go to work for you the minute it's installed!

### Get SSUnit Plus Features!

Remember, too, that SSUnit Pumps are coupled to the famous Allis-Chalmers Lo-Maintenance Motor . . . the motor that's setting new records for low cost operating efficiency under conditions that many times wreck ordinary motors in a few weeks!

Get these plus features! And get Allis-Chalmers undivided responsibility of making both the motor and pump . . . undivided responsibility that means no "buck-passing" to you!

THIS SMALL ALLIS-CHALMERS SSUnit Pump is doing a big job in keeping down pumping costs for the air conditioning system in this modern hospital.

Call the nearest district office or write direct to Allis-Chalmers. That's the way to join the hundreds of other plant managers who are getting real, extra value pumping performance at lowest cost!

1110

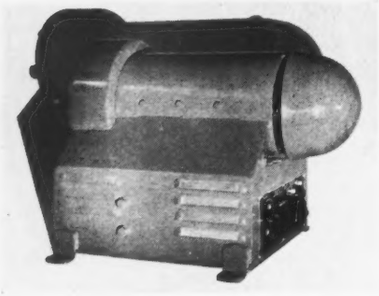
*. . . 90 Years of Engineering Superiority Work for You When You Specify Allis-Chalmers!*

CENTRIFUGAL PUMP DIVISION

ALLIS-CHALMERS

MILWAUKEE · WISCONSIN

lowering the load. These pawls lock on the chain under load stress, and cannot be released until a lever tension is applied. This feature tends to keep the load under control at all times. The chain moves freely forward when taking up surplus, and by a short movement on thumb latch it can readily be restrung for taking another hitch. The body is fitted with universal connection and hook, allowing for quick attachment and free movement in any direction. Paramount Equipment Co., P. O. Box 901, Tulsa, Okla.

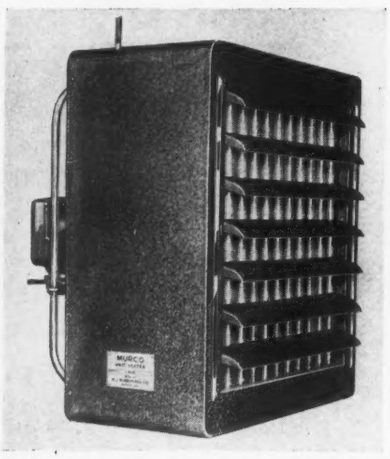


## Arc Welder

"Shield-Arc Junior" welder has been built for use in conjunction with an engine or electric motor drive. It is a small unit for light work, such as light-gage metal, galvanized sheet, cast iron parts, fabrication of angle iron and plate parts and structures, and hard facing. Can be used with either bare or shielded-arc-type electrodes. Is direct-coupled to gasoline engine or belted to a power take-off from an engine, or connected by belt to lineshafting or an electric motor. Rated at 200 hp., its current range, welding duty, 30-volt arc, is 60 to 250 amp. Has "dual continuous control," which permits independent adjustment of voltage and current, can be operated with relatively large-size electrodes at high average current without danger of burning out, it is said. The Lincoln Electric Co., 12818 Coit Road, Cleveland.

## Unit Heater

"Murco" unit heater, for space heating with steam or hot water, is available in 16 sizes. Heavy-wall copper tubes and fins constitute the heating elements. Condenser



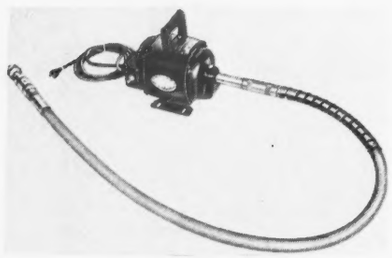
is "full floating" to overcome contraction and expansion. Motor is totally inclosed. D. J. Murray Mfg. Co., Wausau, Wis.

## Portable Sander

Model BB-10 "Take-About" electric hand sander has high belt speed and a dust-collecting system by which all dust is gathered in a bag at the rear of the unit. Said to be cool operating and practically dustless. Has silent change drive. Lever control expedites belt change; correct tension on belt is maintained automatically. Can be used on wood, metal, stone, glass, plastics. Has universal 115-volt, 25- to 60-cycle, or d.c. motor. Belt size: 3 in. wide by 27 in. circumference. Belt speed: 1,475 f.p.m. The Porter-Cable Machine Co., Syracuse, N. Y.

## Flexible-Shaft Machine

Model AJ combination flexible shaft machine consists of motor, flexible shaft, clamp spindle, and extension cord and plug. For bench and portable use it is fitted with conventional base and with carrying handle. Can be operated in close



quarters. Is applicable to grinding, light drilling, polishing, sanding and filing operations. Motor choices: ¼ hp., 1,750 r.p.m.; ¼ hp., 3,400 r.p.m.; 1/3 hp., 1,750 r.p.m., and ½ hp., 3,400 r.p.m. Stow Manufacturing Co., Inc., Binghamton, N. Y.

## Armature Winding Yoke

Armature winding yoke, to wind any type of armature with a shaft from 9–19 in. long, is made with a base suitable for mounting on the face plate of a lathe or turning device. The wires are guided into the slot by hand. Two cast iron arms, fastened to a round cast iron mounting base, may be adjusted to increase or decrease amount of span of yoke by swinging them toward or away from center of disks. Each arm has an index pin which falls into holes on mounting base thus centering work. There are 9 holes per arm. Steel jaws on each arm clamp the armature which may be rotated in the jaws while still being clamped in position. A third arm is used to form the loop after winding each coil by twisting the wire around the steel pin before starting the next coil. This arm is adjustable as to position. Net weight is 28 pounds. Ideal Commutator Dresser Co., Sycamore, Ill.

## Metal Spray Gun

"Speedmaster" metal spray gun is designed to spray all metals that can be obtained in wire or rod form. Its capacity is said to range from 8 lb. of aluminum per hour to 80 lb. of lead per hour. Can be used for rebuilding and reconditioning crankshafts, piston and pump rods, printing press cylinders, shafting, and so on. Tanks and vats can also be lined with protective metals by this gun. Has heavy bronze gears, all shafts ball-bearing mounted, and is self-lubricated. Poppet-type valves segregate the gases. Nozzle is one-piece type, having but one gas joint. Wire feed mechanism can be removed from casing in one unit for inspection. The Master Metal Spray Co., 2527 Magnolia St., Oakland, Cal.

## Sealed Ball Bearings

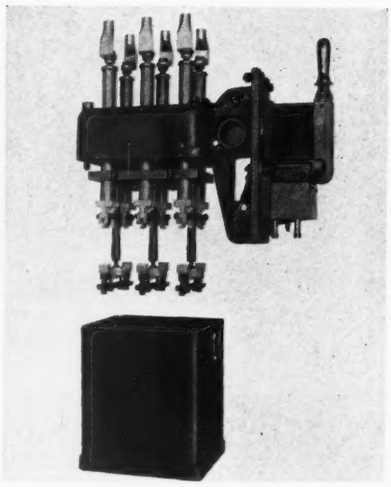
Line of double-felt-seal ball bearings uses a seal that can be applied to ball bearings having a standard single row S.A.E. dimension of bore, inner and outer race width. Designed on air-cleaner principles, sealing against dirt by the felt fiber contact on the polished surfaces of the inner race, and by the utilization of the natural tendency of deflected felt to resume its original flat shape. The seal retains the bearing lubricant and excludes dust or dirt entry into the bearing, yet sealing action is light and friction drag low, it is claimed. Available for shafts up to approximately 1 in. in diameter. SKF Industries, Inc., Front St. & Erie Ave., Philadelphia.

## Flange Bearing Unit

Self-contained flange and take-up bearing unit has been added to the "Sealmaster" bearing line. Seals are built in as an integral part of the bearing proper, independently of the housing. Seal is of the centrifugal labyrinth type and seals the unit against foreign material while retaining the lubricant. Misalignment of the shaft cannot interfere with the seal's effectiveness, for even though bearing is removed from the housing dirt cannot enter. Stephens-Adamson Mfg. Co., Aurora, Ill.

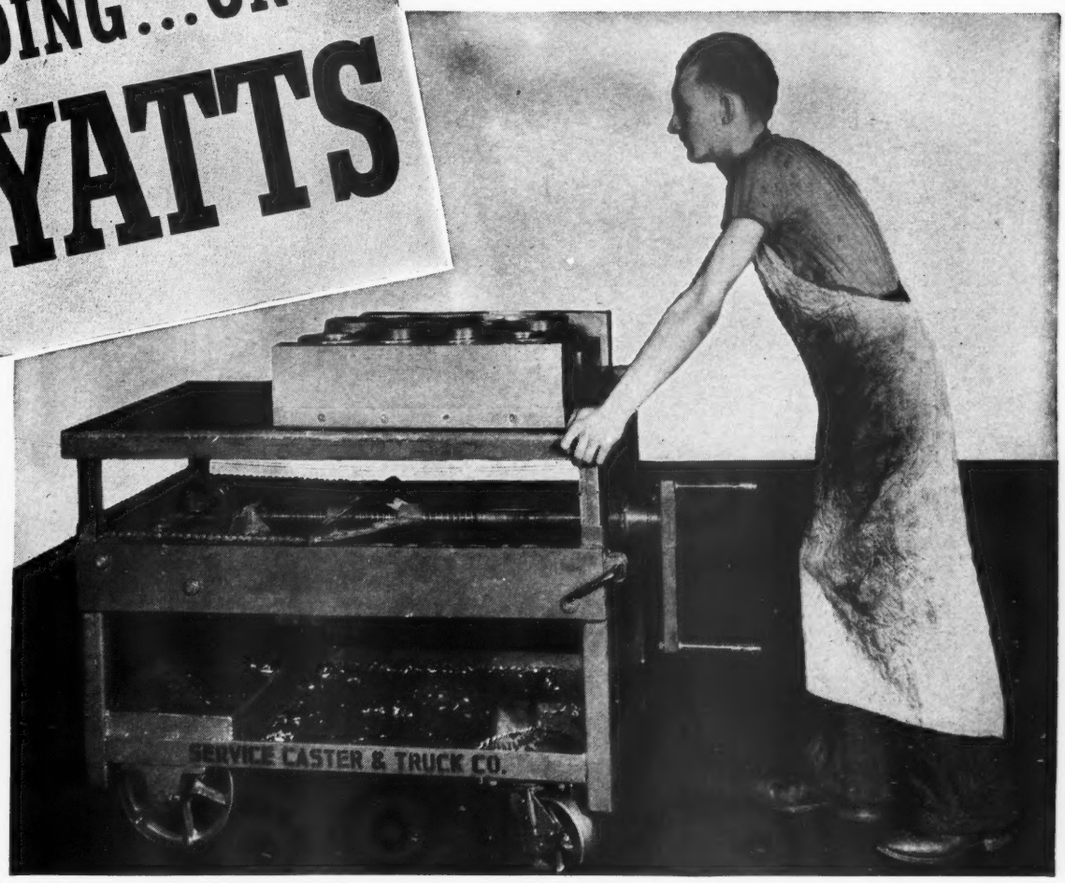
## Oil Circuit Breaker

Type KD-20 switchboard-type oil circuit breaker has 50,000 kva. interrupting



# SMOOTH GOING...ON HYATTS

**This portable, mechanical lift-top die table is the latest addition to the many types of factory trucks, built by the SERVICE CASTER AND TRUCK CO., equipped with dependable Hyatts.**



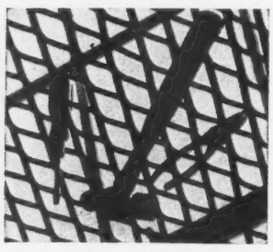

Built for speed and endurance under precision standards, Hyatt Roller Bearings play an essential role in the smooth functioning of machinery. They absorb the uneven surges of force...they conserve power...they promote operating efficiencies. They avoid friction, wear, attention, and replacement. It is this kind of performance and economy that Hyatts add regularly to new equipment design . . . and explains why leading builders of machinery use them year after year in ever-increasing numbers. Hyatt Bearings Division, General Motors Sales Corporation, Harrison, New Jersey; Chicago, Pittsburgh, Detroit, and San Francisco.

**HYATT** *Roller Bearings*

# STRONGER
## *Per Pound of Weight*

# THE NEW
# EXPANDED METAL WALKWAY MESH
### *Adds to Safety • Reduces Costs*

THE DIAGONAL strands in Steelcrete Expanded Metal Walkway Mesh distribute stresses over a greater area than is possible in ordinary walkway materials. Carrying capacity is increased and deflection of the walkway is substantially reduced. In the above illustration the man's weight is distributed over the entire shaded section.



*Even screwdrivers can't drop through the new Steelcrete Expanded Metal Walkway Mesh which has 8½ diamonds (measured the narrow way) to every 12" or 3 diamonds (measured the long way of the diamonds) to every 12"*

Because of its greater strength per pound of weight, the new Steelcrete Walkway Mesh requires lighter structural supports. This reduces costs; and in the case of skylight walks it means a lighter load on the roof structure. It also means shallower strands or members and better diffusion of light together with better visibility. Full details including load capacity and sizes of sheets furnished on request. Available in stock size sheets, cut to size or fully fabricated as you prefer. Write today.

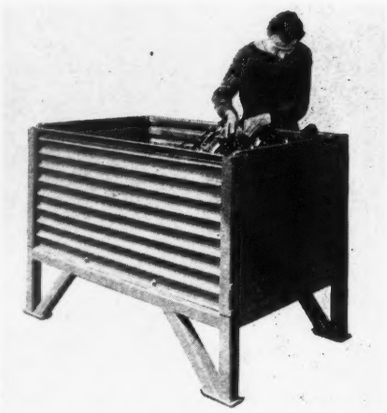
*"IT'S WHEELING STEEL"*

**THE CONSOLIDATED EXPANDED METAL COMPANIES**
WHEELING, WEST VIRGINIA
*Branch Offices and Warehouses:*
New York • Chicago • Detroit • Cleveland • Pittsburgh • Philadelphia • Boston • Buffalo • Houston • Atlanta
*Export Office:* 330 West 42nd St., New York, N. Y.


rating. The three poles are arranged one behind the other as viewed from the front or operating end of the breaker. The arrangement of the bushings so obtained eliminates the necessity of crossing the leads in certain applications of open and inclosed-type switchboards. Equipped with large butt-type arcing contacts; the main current carrying contacts, silver-plated, are of the wedge and finger type for 600 amp. and wedge and laminated brush type for 1,200 and 2,000 amperes. Furnished for 600 amp. at 15 kv., 1,200 amp. at 7.5 kv., and 2,000 amp. at 5 kilovolts. Arranged for flat surface mounting or for mounting in cells, switchhouses, cubicles, metal clad switching equipment, and safety inclosed switchboards. Allis-Chalmers Mfg. Co., Milwaukee.

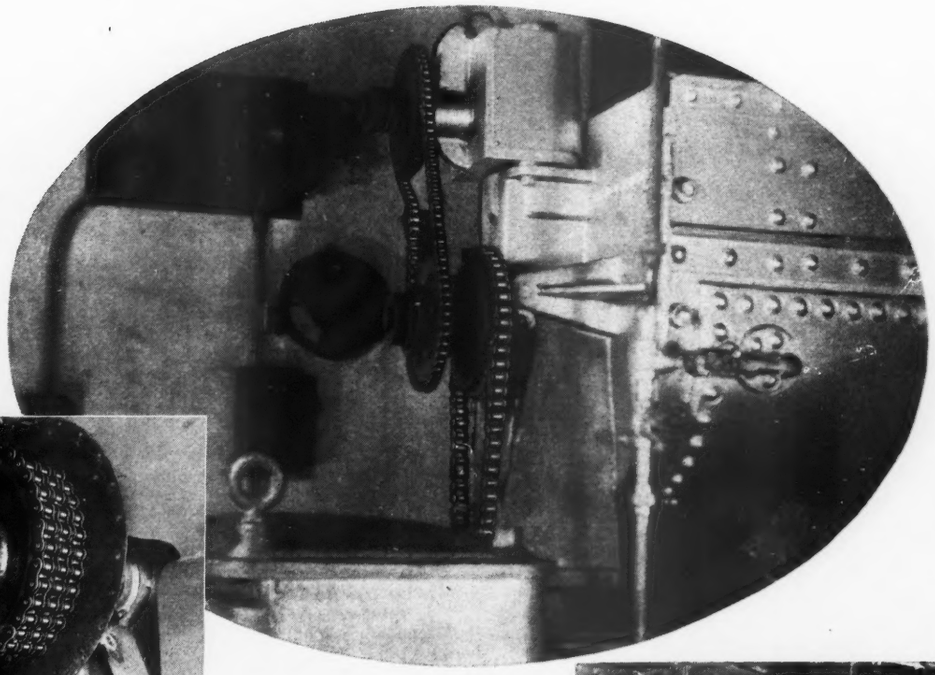
### Photoelectric Smoke Control

"Electric Eye" smoke control may be mounted on either flue or stack, and indicates by a bell or other signal located in the boiler room, when the smoke passing through the furnace flue exceeds a predetermined density. The control and light source are mounted on opposite sides of the flue or chimney on rigid brackets. The light beam projects through a small opening in the flue, across the inside of the flue, and through a second opening to the control. Operates on 110-volt a.c. supply. Dustproof and moisture-proof housings. Photoswitch, Inc., 21 Chestnut St., Cambridge, Mass.



### Bin, Rack, and Skid

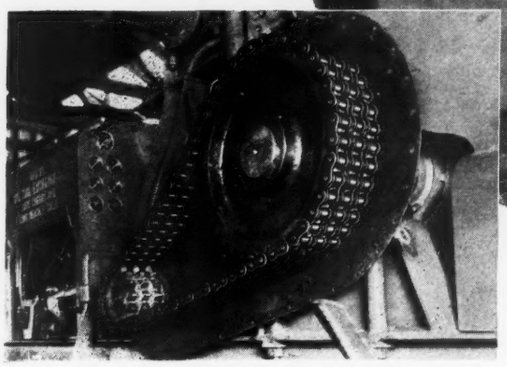
All-steel work container combines in one unit three distinct types of work handling equipment—a bin, rack, and skid. The "Collapsi-Bin" is designed so that it can be used as a shipping container as well as for interdepartmental metal handling or storage. It is of heavy-duty construction with a capacity of 8,000 lb. A base frame of square steel tubing is integral with a steel plate to form a smooth surface pallet. Left and right side panels of corrugated steel have corner posts of steel tubing which extend downward to meet inside the legs of the skid to form a rack. End panels, also of corrugated steel, reinforced with an angle steel frame, form a secure joint with the side panel corner posts through a self-locking device. By use of nestling plugs which slip into the top of



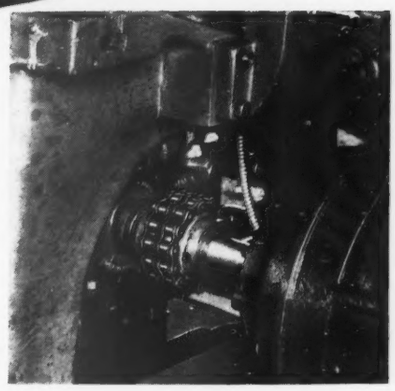
*Baldwin is a good mixer.* Always at home on any job—it's the prime favorite for mixing operations like this one.

•

*Strong and Silent.* And fast enough to act as a primary drive. Here's how a diesel engine designer uses Baldwin Roller Chain.

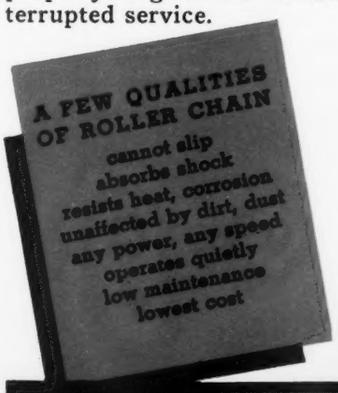


*Chain makes perfect flexible couplings.* Better send for a Baldwin Flexible Coupling booklet if you haven't one. This illustration shows how compact they are.



# *Baldwin* HELPS BOOM BUSINESS

How? By furnishing lower cost power transmission and conveyor drives. Low *first* cost—for Baldwin Machine Finished Roller Chain and accurate-cut sprockets are *not* expensive. Low power consumption—because the continuous high efficiency (over 98.6%) of Baldwin Roller Chain means *all* the power is transmitted *all* the time. Lower *ultimate* cost, because properly engineered Baldwin chain drives give long, uninterrupted service.



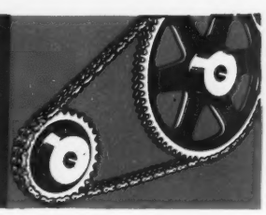

Here are three out of thousands of Baldwin Roller Chain applications. They suggest why able plant managers find it increasingly profitable to use Baldwin Roller Chain and Baldwin engineering and design service. Call the B-D man today.

**BALDWIN-DUCKWORTH**
*Division of*
**CHAIN BELT COMPANY**
Springfield, Massachusetts
Factories at Springfield and Worcester, Mass.

## HOW GOOD IS YOUR *DAYTIME* PROTECTION?

Safeguarding daily production is Baldwin Chain's big job. Its long life at continuous high efficiency makes it the choice of more and more informed designers every year.

**BALDWIN-DUCKWORTH**



# NEOPRENE WORK SHOES LAST 4 TIMES LONGER

**THE PROBLEM:** In a certain manufacturing plant, all of the workmen except one had trouble with their shoes. The soles of these shoes wore out at an alarming and expensive rate, though their owners didn't know exactly why.

**THE SOLUTION:** Presently the one workman with the trouble-free shoes volunteered some valuable information. Since oil, grease, acids and abrasion were encountered daily in his work, he had asked his shoe store for shoes whose soles were specifically designed to resist these harmful factors. And the store had wisely recommended soles made of Du Pont neoprene. (In the picture above, you see this workman's neoprene-soled shoes after eight months' wear, four times longer than ordinary shoes—yet still with a lot of good service ahead.)

**THE MATERIAL:** Neoprene, Du Pont's remarkable chloroprene rubber, has the strength, resilience and toughness of natural rubber—but it is far superior in resistance to oils, grease, gasoline, heat, sunlight, aging, and even corrosive gases and acids.

**A SUGGESTION:** Doesn't this suggest that you can profitably use or recommend neoprene in your own plant—not only neoprene work shoes but also neoprene in your manufacturing processes? Neoprene-soled shoes are sold through usual channels. Order neoprene products from your rubber supplier.

DU PONT REG. U.S. PAT. OFF. **NEOPRENE**

**E. I. DU PONT DE NEMOURS & CO., INC.**
**RUBBER CHEMICALS DIVISION, WILMINGTON, DELAWARE**


each corner post, and into the legs, "Collapsi-Bin" units can be set one on top of another. Measures approximately 3 x 5 ft.; 40 in. high. Mechanical Handling Systems, Inc., 4700 Nancy Ave., Detroit.

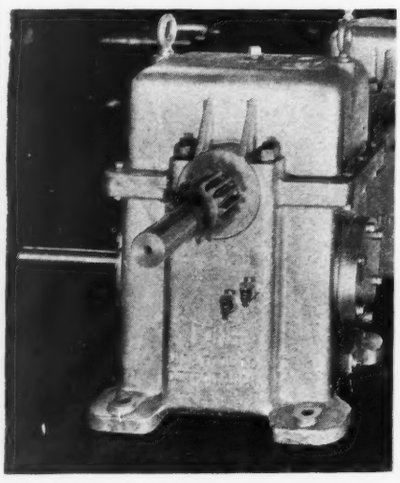
### High Bay Lighting Unit

Designed for use with incandescent lamps for general lighting of high bay

areas in foundries, machine shops, receiving and shipping departments, a high bay aluminum reflector incorporates the "Locklite" principle of attaching industrial reflectors. When lugs on the neck of the reflector lock into slots of the hood and receptacle, the electrical connection is made. This is accomplished by giving the reflector a clockwise turn of 60 degrees. The lamp will not light until the reflector is locked to the hood. Westinghouse Electric & Mfg. Co., Cleveland.

### Speed Reducers

Heavy-duty speed reducers incorporate "cone" area-contact type of worm gearing. All are of vertical worm-in-bottom type, with rugged cast housings of high tensile nickel iron. Worms are of chrome-molybdenum-nickel steel and worm wheels of nickel bronze. Anti-friction bearings are used throughout except for the sleeve bearings on the gear shaft in the larger units. Roller bearings are used on the gear shaft for the smaller and intermediate types. Worm shafts are carried in ball thrust and roller radial bearings of larger reducers. Models range from 3 in. to 15½



ARE YOU PAYING FOR HEAT AND BUYING A Shadow?
Condensed water collecting in unit heaters blocks off some of the heating surface — casts a long, cold "shadow" where there should be heat!

# NO *"SHADOWS"* TO PAY FOR WITH THERMOLIER!

Thermolier's broad, continuous beam of heat is never "shadowed" – because condensate is drained *continuously* by the Internal Cooling Leg, exclusive with Thermolier. All of the heating surface *works*, all of the time.

Grinnell's 50 years of heating experience created the Internal Cooling Leg . . . plus *13 other* outstanding points of superiority. They're all described in the 48-page Thermolier Data Book that covers Thermolier's 3 types and 30 sizes. Send for a copy. Grinnell Company, Inc., Executive Offices, Providence, R. I., branch offices in principal cities of U. S. and Canada.

**USERS REPORT:**

*75 tons less coal used per season — saving 35% — since Thermoliers were installed in a Railway and Dock Shop.*

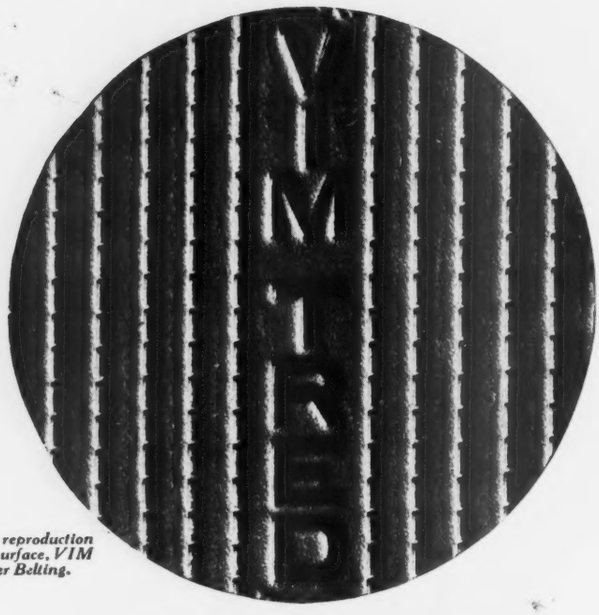
*29% less steam consumed, after Thermoliers went into a well-known textile plant.*

*Manufacturer with over 50 plants averages overall savings of 30%. $50 per day in one plant alone . . . $5500 per year in another.*

# GRINNELL THERMOLIER

THE UNIT HEATER WITH 14 POINTS OF SUPERIORITY

# CERTIFIED




*Actual size reproduction of treaded surface, VIM Tred Leather Belting.*

# LEATHER BELTING

## ....*certified* to cost you *less* per unit produced!

. . . and we'll prove this to you in *your* plant, as we have in many plants throughout the country. Every VIM TRED Leather Belt shipped bears the certification that it will cost less per unit produced than *any other belt* under identical conditions.

The exclusive tannage of VIM TRED Leather Belts gives them an exceptionally high coefficient of friction, longer life—and their patented tread provides better grip, increased pulling power. Houghton's transmission experts are available in all industrial areas. They're as near as your telephone.

***If you prefer, write for special booklet.***

**E. F. HOUGHTON & CO.**
PHILADELPHIA
Chicago Detroit

**VIM TRED**
**LEATHER BELTING**

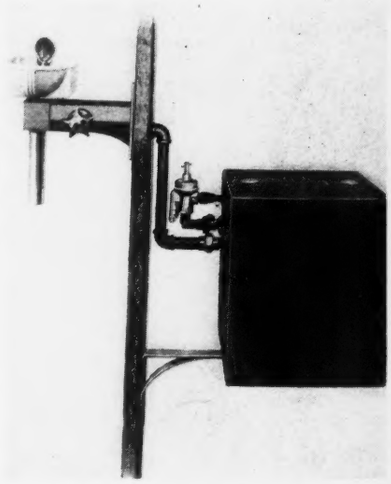

in. center distance, with a wide selection of standard ratios for each size. Michigan Tool Co., 7171 East McNichols Road, Detroit.

### Reset Timer

"Multiflex" synchronous, motor-driven, reset timing relay, for applications requiring one or more contact operations in a timed sequence, controls operations on semi-automatic and full automatic machine tools and molding presses, opening and closing of valves in tools and in chemical or washing processes, starting groups of motors. It consists of a moving plate driven by a synchronous timing motor through a solenoid-operated clutch. Timing adjustments are regulated by "on" and "off" indicators independently adjustable along a linear time scale by loosening a thumb screw. Vernier adjustments can be provided. Operation is controllable by manually operated switches, start-stop buttons, limit switches, pressure switches, photocell relay contacts. Timers, for controlling from 1–6 circuits, may be supplied in a single unit with opening and closing of each circuit independently adjustable. Eagle Signal Corp., Moline, Ill.

### Water-Cooling Unit

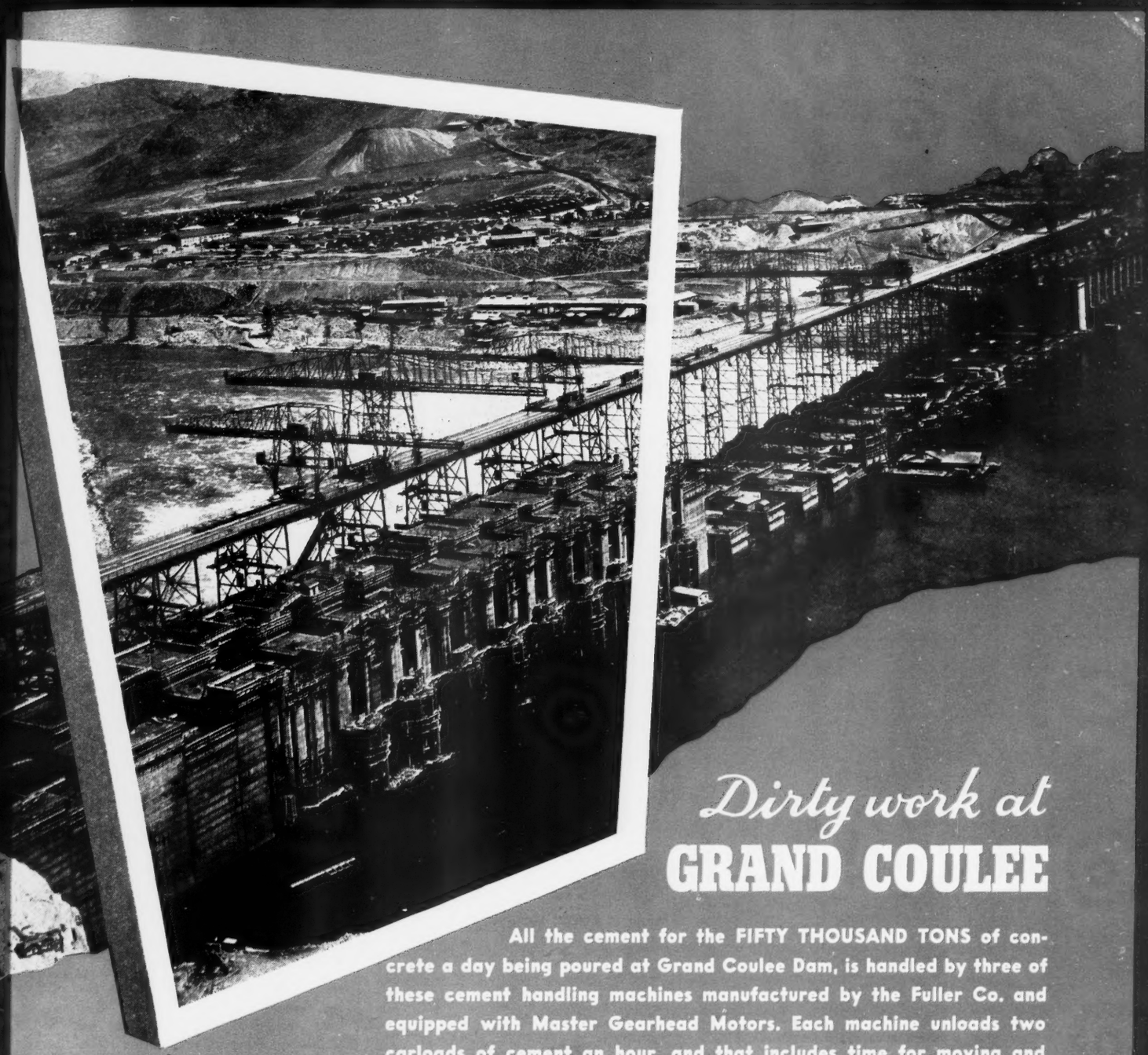
Water cooler for single and multiple installations operates from a remote re-



frigerating unit. It consists of a cooling unit combined with water tank and coil. Refrigerant is run through copper tubing to each cooler from a condensing unit installed at an out-of-the-way location. Desired water temperature is automatically maintained. Available in two sizes (wall and floor-cabinet types) up to 40 and more gallons per hour, depending on size of condensing unit used. May be furnished for sulphur, methyl or Freon refrigerant. Cordley & Hayes, 145 Hudson St., New York.

### Hoist

Hoist, equipped with explosion-proof electrical equipment, is designed for handling duty in hazardous locations. A 30-min., 55-deg. motor and explosion-proof reversing starter, together with geared upper and lower limit switches and push-



# *Dirty work at* GRAND COULEE

All the cement for the FIFTY THOUSAND TONS of concrete a day being poured at Grand Coulee Dam, is handled by three of these cement handling machines manufactured by the Fuller Co. and equipped with Master Gearhead Motors. Each machine unloads two carloads of cement an hour, and that includes time for moving and spotting cars. It's a tough, dirty, gruelling 24-hour-a-day job that demands unusual stamina in all equipment.

When YOU want electric motors, no matter whether it's for tough, dirty jobs or for extra clean precision jobs, investigate MASTER'S unusual ability to furnish you with motors in any size from 1/10 to 100 horsepower, that meet exactly your individual requirements.

THE MASTER ELECTRIC COMPANY • DAYTON, OHIO

MASTER

# Top Quality BRUSHES

The Pittsburgh Plate Glass Company offers brushes for every industrial need.

***Gold Stripe Brushes***

Made of Pure Black Chinese Bristle—selected and mixed by master craftsmen. Each brush planned for maximum carrying capacity and designed for a specific paint application.

***Industrial Brushes***

Floor Sweeps, Mill Dusters, Wire Scratch and Casting brushes. Also Spiral Wound brushes of wire, horsehair and tampico for large scale production.

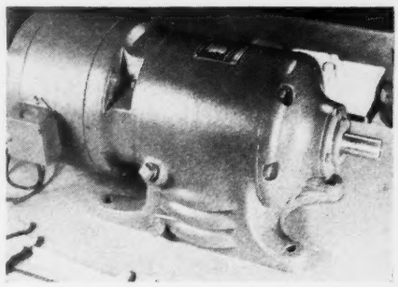
Investigate. You can save money by concentrating your brush purchases in this one reliable source of supply.

***Overnight Service***

For the convenience of its customers, the Pittsburgh Plate Glass Company maintains 79 centrally located service warehouses. Orders for brushes are regularly filled on a 24 hour basis.

PITTSBURGH
PLATE GLASS COMPANY
BRUSH DIVISION · BALTIMORE, MD.
WAREHOUSES IN 79 IMPORTANT MARKET AREAS


button stations, are part of the equipment. All this equipment bears underwriters' approval for Class I, Group D hazardous locations, it is said. Wiring is in rigid conduit with explosion-proof fittings, and the electric brake is inclosed in a heavy cast iron cover which is bolted to the gear case cover. Further reducing the possibility of sparking, a flexible cable connection is used, together with spark-proof trolley wheel. Harnischfeger Corp., 4400 West National Ave., Milwaukee.



## Geared Motor Reducer

Type SME Ratiomotor is a straight-in-line motorized reduction unit. It is available in five output speeds—108, 144, 172, 230, 276 r.p.m.—and with either ½- or ¾-hp. motors. All motors are a.c., 60 cycles, 1,800 r.p.m., and are available for 110, 220, or 440 volts. Boston Gear Works, Inc., North Quincy, Mass.

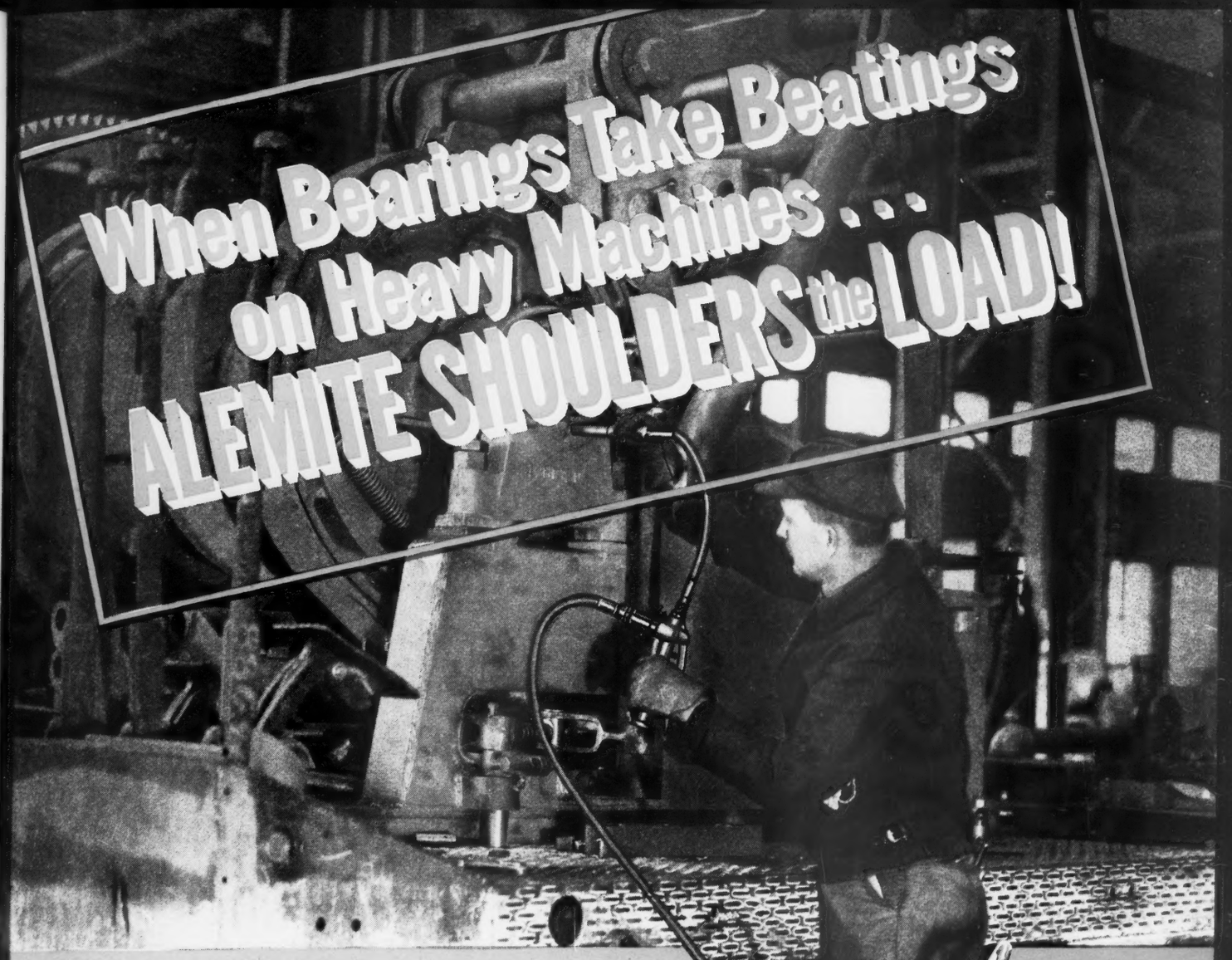
## Arc Welder

"Transarc" a.c. arc welder has range of 20 to 200 amp. and is to be used on 220-volt single-phase power lines. Safe operation is featured, in that no electrical or mechanical connections exist between power line and welding lead. Stable arc is another feature, as is the large number of steps for adjusting welding current. Mounted on hard-rubber, ball-bearing casters. Hand grips on each side for lifting. Inner control can be used to disconnect welder from power line without pulling power plug or shutting off regular line switch. Dimensions: 32 in. high, 18 in. wide, 14 in. deep. Hobart Brothers Co., Box TA-69, Troy, Ohio.

## Floor Truck

A hardwood deck bound with high carbon steel angles to prevent splintering and cracking at the edges is one of the features of a new floor truck. Wide semi-steel wheels are designed to give protection to floors. Brackets supporting the pushbar

# When Bearings Take Beatings on Heavy Machines . . . ALEMITE SHOULDERS the LOAD!

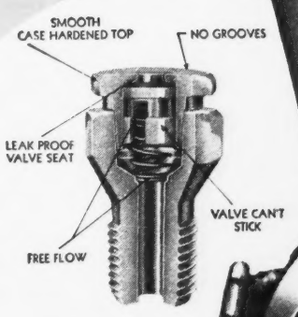


## All Bearing Surfaces Must Be Protected to Insure Dependable Performance

SUPPOSING there's a 25-ton load on a big bearing. Supposing any part of that bearing runs dry, leaving metal against metal . . . *it's good-bye bearing, fast!* Lubricant *must* take up the strain, and the responsibility for getting that protective film of grease in there, to safeguard the bearing, rests entirely on your lubrication equipment!

No other gun on the market can duplicate the performance of the Alemite "Rock Crusher" Power Gun when it comes to delivering a volume of heavy fibrous lubricant *dependably, under high pressure, without trouble!* Its exclusive, patented helix arm and worm provide a continuous flow of grease when you want it, insuring positive priming, completely doing away with annoying air pockets!

There are other Alemite Power Guns to meet other requirements—to pump grease of any consistency direct from original drums, powered either by air or electricity, *and built to stand the punishment of continuous modern production.* Get your FREE copy of our new industrial catalog! Write today!




*This new type FREE FLOW Alemite Giant Button Head Fitting belongs on every heavy duty machine bearing requiring a large volume of grease under pressure. Opens readily under slight pressure; closes instantly when pressure is released. Makes thorough lubrication easy.*

*Lubricating hoist drum shaft at Marion Steam Shovel plant with Model 6524 Alemite "Rock Crusher" Power Gun. This bearing operates under 25 tons of stress.*

ALEMITE—*A Division of Stewart-Warner Corporation*
1870 Diversey Parkway, Chicago, Illinois
*Stewart-Warner-Alemite Corp. of Canada, Ltd., Belleville, Ont.*

# ALEMITE

REG. U. S. PAT. OFF.

**WORLD'S LARGEST MANUFACTURER OF LUBRICATION PRODUCTS**

# 25% more "GUTS" in loading chain

**WHEN YOU SEE THESE "SWELLS" AT THE WELD**

● That's where a link needs strength the most—at the weld. Hercules Steel Loading Chain has plenty of extra strength at this vital point—extra metal, inside and out of the way, put there by the patented "Inswell" welding process. The chain itself is fabricated of special analysis, heat treated steel—and carefully tested to *twice* its safe working load. Look for the identifying "H" on the link—it's your guarantee of 25% more strength, safety and wear. Your dealer has all the details—or write us direct.

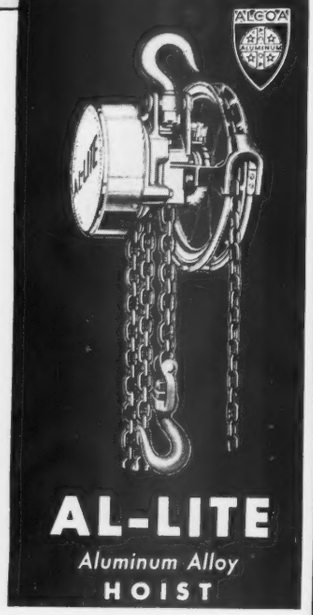
**HERCULES *Steel* LOADING CHAIN**

**COLUMBUS-McKINNON CHAIN CORPORATION**
*(Affiliated with Chisholm-Moore Hoist Corporation)*
130 FREMONT AVE. TONAWANDA, N. Y.
*Branch Offices:* NEW YORK • CHICAGO • CLEVELAND

# WORLD'S LIGHTEST WEIGHT HEAVY-DUTY HOIST

## puts an end to the overload hazard

All the features you're looking for "wrapped up" in one hoist—the AL-LITE! Yes, sir, it's one-third lighter than hoists of comparable capacities because it's built of that remarkable Alcoa aluminum alloy. This makes it easy to handle—a real "one man hoist". Yet in spite of its lightness the AL-LITE is strong and rugged, and equal to the toughest assignments. Equally important is the patented AL-LITE Safety Governor that works automatically independent of the load brake—a safety feature that warns against dangerous, excessive overloading . . . Other outstanding features include simplicity of design, fewer parts, 5 to 1 safety factor, corrosion resistance, adjustable brake, "Inswell" chain, oil bath lubrication . . . Get those hoisting jobs done quickly, the *safe* AL-LITE way. Ask your dealer—or write for literature.

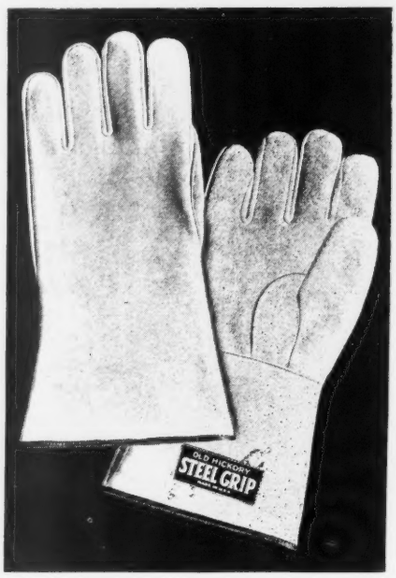



**CHISHOLM-MOORE HOIST CORPORATION**
*(Affiliated with Columbus-McKinnon Chain Corp.)*
130 FREMONT AVE. TONAWANDA, N. Y.
*Branch Offices:* NEW YORK • CHICAGO • CLEVELAND


can be removed to permit installation of a box, rack, or shelf-type substructure. It is said the truck is ruggedly reinforced, especially the front wheels, to provide easy joining and minimize dangers of overloading. Barrett-Cravens Co., 3255 West 30th St., Chicago.

### Welders' Glove

"Safeguard" No. 13475 is a one-piece-back welders' glove in which the entire back is made from one piece of leather to eliminate burning out of seams. A wide leather strap protects and reinforces the




thumb seam, and all other seams, at points of greatest wear, are welted for extra reinforcement. A wool heat-breaker is sewed to the back of the glove to provide insulation. Leather used is shrink-proof and heat-resistant, and is said to remain soft and flexible under most severe temperature conditions. Glove can be supplied in all lefts or all rights, or in any combination of lefts and rights. Industrial Glove Co., 714 Garfield Blvd., Danville, Ill.

### Face Shield

"Dependon Safety Shield" may be described as a small bay-window held in front of the wearer's face, leaving him with an unobstructed view. The window material is synthetic, made to withstand heat, sparks, and acids, and is so removed from the face as to allow perfect ventilation and the wearing of glasses or goggles. Material is available in either clear or tinted effect, and is made in various depths from forehead to chin. Window is attached by swivel joint to an adjustable head band, and window can be swung up above the wearer's head. Can be used in grinding, plating, and welding operations. Sellstrom Mfg. Co., 615 North Aberdeen St., Chicago.

### Photoelectric Counter

Model 566 photoelectric counting equipment and Type 566 contact relay, together

*(Continued on page 112)*

# $3200.00 WORTH OF FUEL SAVED IN ONE YEAR WITH ILG UNIT HEATERS.

## . . . BUT THAT'S ONLY HALF THE STORY

Using Ilg Unit Heaters for heating their Long Island, N. Y. plant, the International Motor Truck Co., manufacturers of Mack Trucks, cut their fuel bills about $3200.00 in one year — saving 182,000 gallons of fuel oil and replacing 25,000 feet of pipe coils, 200 radiators, and 500 valves. Since 1921, 18 different Mack Truck plants have installed Ilg Unit Heaters.

The Mack Truck experience with Ilg Unit Heaters is substantiated by the testimony of hundreds of nationally-known firms. Leading industrial organizations like Ford, Eastman Kodak, Pittsburgh Plate Glass, Pennsylvania R. R., Real Silk Hosiery, Independent Pneumatic Tool, Union Carbide & Carbon Company, recognized the advantages of Ilg Unit Heaters years ago. They bought Ilg Unit Heaters — and bought again. As a matter of record, every third Ilg Unit Heater sold represents a repeat order — a satisfied customer.

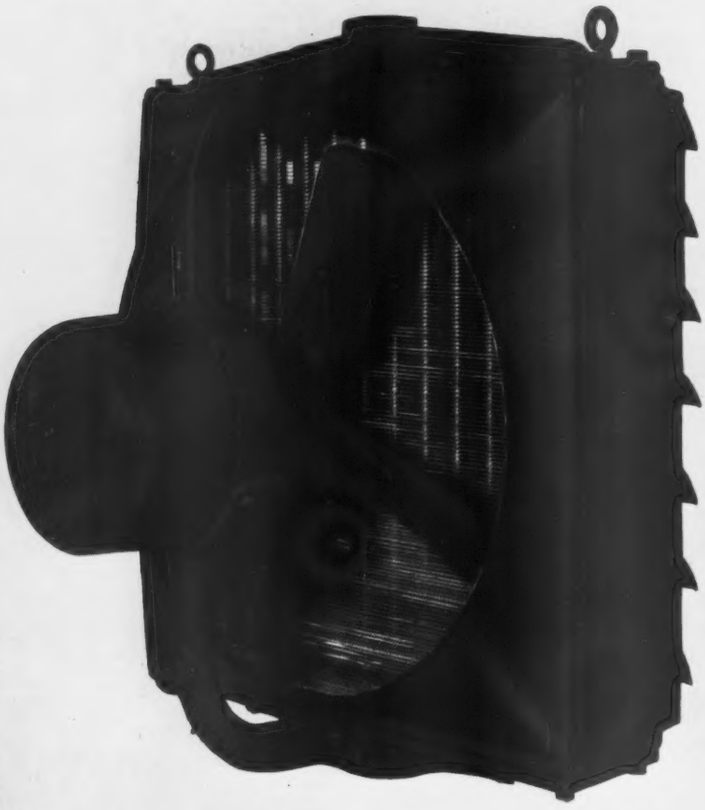
Twenty-two years of performance proves the dependability of the Ilg Unit Heater—a highly specialized product pioneered by Ilg in 1917. Only the Ilg Unit Heater is powered by a self-cooled motor — Ilg-built in its entirety — guaranteed as a complete unit. Everything you want to know about Ilg Unit Heaters, plus factful data, capacities, sizes, etc., is illustrated and described in the new book — "Effective Heating". It's free. Make your request on the attached post-card.

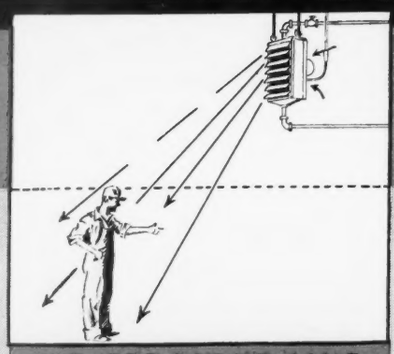
**ILG ELECTRIC VENTILATING CO.**
2865 N. CRAWFORD AVENUE, CHICAGO, ILL.
*Offices in 43 Principal Cities*

## SEND FOR *FREE* BOOK

# ILG UNIT HEATER

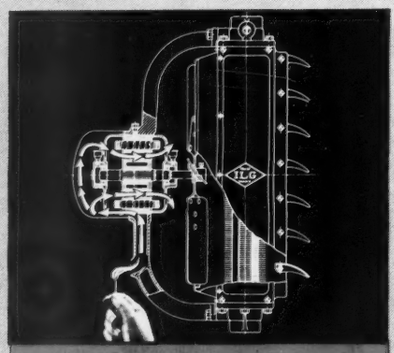
## THE ONLY UNIT HEATER WITH A SELF-COOLED MOTOR





**ILG STRAIGHT LINE BLOW THRU PRINCIPLE**

Illustrating forced movement of air from heating chamber to the floor level. Adjustable deflectors direct and diffuse the heat waves at the breathing zone. Concentrates the heat in the working zone, reducing heat waste at the ceiling.



**ILG SELF-COOLED MOTOR**

Demonstrating the Ilg self-cooled motor feature—positive flow of cool air to heart of motor insures dependable operation at high temperatures.

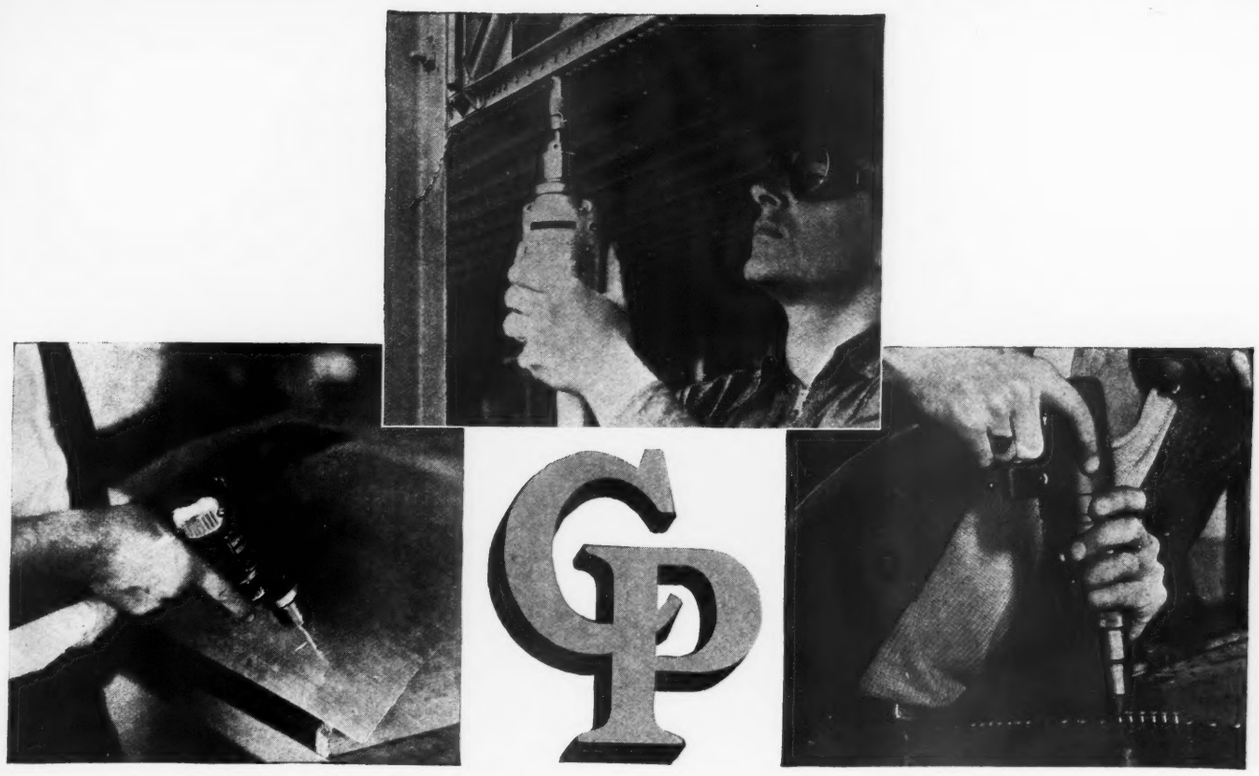
In the final analysis of unit heaters, the motor rates as the most vital part. Any comparison of quality or any measure of efficiency is definitely concerned with the motor. Only the Ilg Unit Heater is powered by the Ilg-built, self-cooled motor — specifically designed for "hot-spot" duty — runs cool — stays cool at high temperatures. A single name plate guarantee covers the complete unit, there is no division of responsibility.

**ILG-BUILT COILS**

Boiler-tight all-copper construction, featuring flat fins flanged on round tubes. No brazing, soldering, or welding. Two piece header construction follows best high pressure steam boiler practise.

**WRITE TODAY**
Detach, sign and mail postcard for free book.

*Ilg Unit Heaters are made in 41 different sizes and capacities.*



# UNIVERSALS
## are production tools
## *BUILT FOR CONTINUOUS SERVICE*

There's a difference in portable electric tools — a difference that is readily apparent when you compare CP Universals with others. » » » CP Universals are built for continuous, production service. They have high torque, high powered, cool-running motors . . . ball bearings mounted in steel inserts . . . through bolts (instead of tapped holes) . . . helical armature gearing and other CP features of design and construction which insure greater production and lower maintenance under the most severe operating conditions. » » » CP Universal Electric Tools are ideal for aeroplane and automotive plants, body builders, sheet metal workers and other production industries. Send for a copy of Catalog No. 899.

**CHICAGO PNEUMATIC TOOL COMPANY**

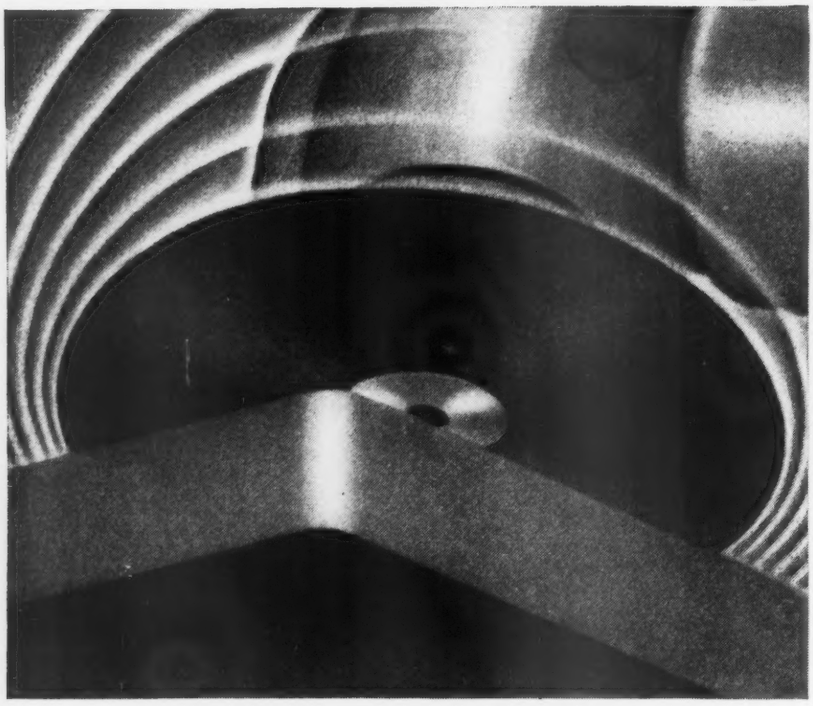
*General Offices:* 6 EAST 44th STREET, NEW YORK, N. Y.

**SALES OFFICES AND SERVICE STATIONS THROUGHOUT THE WORLD**

**CP UNIVERSAL ELECTRIC TOOLS**

**DRILLS • SCREW DRIVERS • NUT RUNNERS • TAPPERS • GRINDERS • SANDERS**

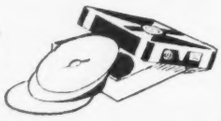
# Make Your Disc Sanders *Stop Cheating*



**On a heavy duty job, the better your disc sander or flexible shaft, the more it can cheat you on performance! For the machine can only spin the sanding disc . . . the disc itself must grind the metal. And ordinary discs that just can't shoulder the load force the operator to let the machine loaf on the job.**

**Make *your* sanders work hard! USE THE DISCS THAT CUT FASTER AND STAND UP UNDER STRESS — the discs that were specially developed for continuous production metal-grinding. The special grits of Jewel Heavy Duty Sanding Discs are sharper and harder. And *triple-screened* for uniformity. Gripped in a sturdy bond to a newly-developed, more durable backing, they'll cut your sanding time and sanding costs.**

**PROVE IT FREE!**



**Order a package for your own work. Use up to half the discs. Then, if you're not completely satisfied, return the balance — and there'll be *no* charge! Ask your dealer or clip the coupon below.**

ABRASIVE PRODUCTS, INC.
519 Pearl St., South Braintree, Mass.

Yes! I'd like to try the new Jewel Heavy Duty Discs Free. Please ask the nearest AP Dealer to take care of me.

*Size:*..... *Grit No.*.....

*Name*.....

*Address*.....

*City*..... *State*.....

**ABRASIVE PRODUCTS**
SOUTH BRAINTREE MASSACHUSETTS
JEWELOX • JEWEL EMERY • JEWEL GARNET
JEWELITE • JEWEL FLINT • NEW PROCESS
INC.


*(Continued from page 108)*

with terminal board, power transformer, and light source, comprise actuating mechanism for a four-digit counter recording up to 600 units per minute. One tube of standard type is used, having within it both rectifier and amplifier elements. Control relay is plug-in type. D.c. operation. Either visible or invisible light will actuate the photoelectric unit. Lipman Engineering Co., 415 Van Braam St., Pittsburgh.

### Diesel Electric Sets

Two self-contained diesel electric sets of 15- and 20-kw. capacities are simple to install, with all electrical equipment inbuilt, with the exception of the circuit breaker. Only connections to be made are from the generator terminal to the circuit breaker and from the circuit breaker to the distribution box. The engines have three operating adjustments, none of which involves the diesel fuel system. Generators are of single unit construction equipped with ball bearings which require lubrication only once in six months. Built-in regulation enables sets to pick up relatively large motor loads with little light flicker and voltage drop. Size 34–15 is supplied in 3 phase; 110, 220, or 440 volts; at 15 kw., 0.8 power factor. It is also available as single phase, 110/220 volts, three-wire type; 110 and 220 volts two-wire type at 13 kw., 0.8 power factor. The 44–20 set is supplied in 3 phase; 110, 220, or 440 volts; at 20 kw., 0.8 power factor; and in single phase, 110/220 volts, three-wire type; and 110 and 220 volts, two-wire type at 18.5 kw., 0.8 power factor. Caterpillar Tractor Co., Peoria, Ill.

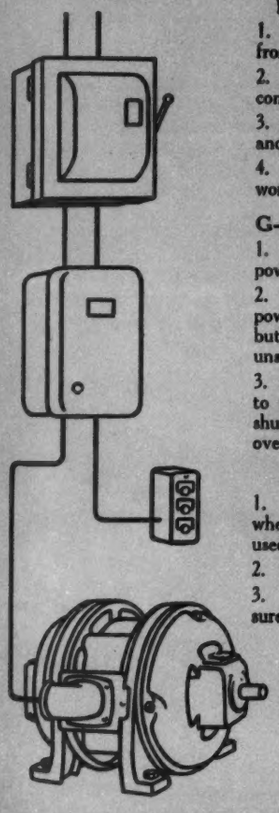
### Hoist

"Speedmaster" hoist comes in capacities of 250, 500, 1,000, 2,000 and 3,000 lb., and features speed of operation. Electric limit switch limits operation and each direction and prevents over-run. Has pistol grip interlocked electric control and quick-acting brake. All models have anti-friction bearings throughout and are available with rail, hook, or lug mounting. All sizes require small headroom and can

# 2 G-E Control Systems

## That Help You Get Maximum Hp-Hours from Motors You Install

POWER SUPPLY



## System A

### MANUAL DISCONNECT SWITCH

1. *Manual Switch* to disconnect control and motor from power supply.
2. *Fuses* (optional) protect against short-circuit conditions.
3. *Manual Circuit Breaker* (used in place of switch and fuses) facilitates resetting.
4. *Provision for Locking* switch in *off* position while working on circuit.

### G-E MAGNETIC MOTOR STARTER

1. *Protects Operators* by isolating control from power circuit.
2. *Undervoltage Protection* disconnects motor when power supply fails. Operator must press START button to restart—prevents injury to operator from unsuspected restarting.
3. *Isothermic Overload Protection* prevents injury to motor from overheating, yet prevents needless shutdowns due to brief or otherwise harmless overloads.

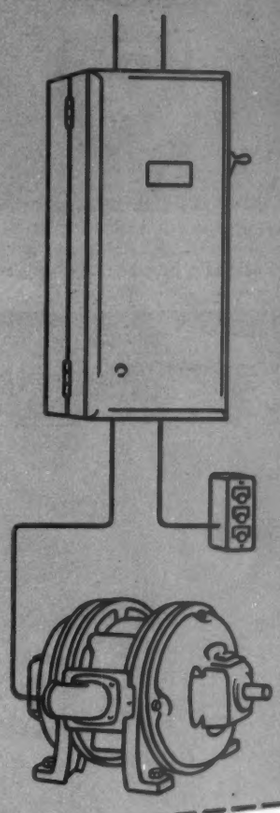
### G-E PUSH-BUTTON STATION

1. *Remote Mounting* permits location right at work where convenient. Any number of stations can be used in parallel.
2. *Large Accessible Buttons* make operation easy.
3. *Automatic Operation* with float, limit, or pressure switches readily obtained.



MOTOR—any a-c induction motor that can be started on "full voltage"

POWER SUPPLY



## System B

### G-E COMBINATION SWITCH

Provides all functions of SYSTEM A:

1. *Manual Switch* with *Fuses* (optional) or *Manual Circuit Breaker.*
2. *Undervoltage Protection.*
3. *Isothermic Overload Protection.*

With these added advantages:

1. *Added Safety* since cabinet cannot be opened unless disconnect switch is open, making all parts "dead" except supply terminals.
2. *Easier Installation.* The single complete control comes ready-wired, so there is only one device to be mounted, and no extra wiring is required.

One optional feature is also obtainable:

1. *Plug Jacks* in cover make it easy to insert testing meters in motor circuit without interrupting operation.

### G-E PUSH-BUTTON STATION

Provides same function as push buttons and pilot devices in SYSTEM A.



IN SELECTING a motor, maximum uninterrupted horsepower hours, and characteristics that suit the job are two primary considerations. *These same factors* should govern the choice of its control. The control should provide long life, safety for operators, and correct overload protection. The best way of obtaining *all* these is to specify a G-E control system.

*General Electric Co., Dept., 6D-201*
*Schenectady, N. Y.*

*Please send me additional data on control for motors. I am interested in:*

- ☐ SYSTEM A
- ☐ SYSTEM B
- ☐ Push-button Stations
- ☐ .....

*Name* .....

*Firm* .....

*Address* .....

080-195

# GENERAL ELECTRIC

*believe it or not*

# IT'S THE SAME SHOP!

**BEFORE** the Aetna Ball Bearing plant in Chicago installed modern lighting, a Light Meter check-up revealed insufficient light and spotty distribution of light for easy seeing. This was caused principally by poor spacing and mounting of fixtures and the use of wrong size lamp bulbs.

**AFTER** the plant was light-conditioned, seeing conditions were greatly improved. Present installation includes Glassteel Diffusers spaced on 12-foot centers, each equipped with a 300 watt G-E MAZDA lamp, the kind that *stay brighter longer.*

*Light Sensitive Cell*

*Ask your electric service company to measure your lighting with one of these G-E Light Meters.*

**G-E MAZDA LAMPS**

**GENERAL ELECTRIC**

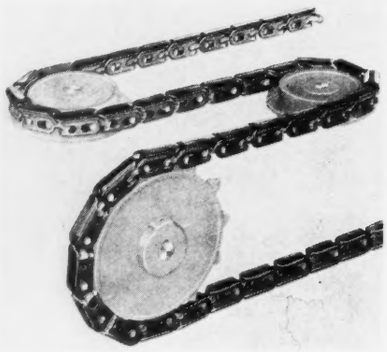

be used inside or out. Any length of lift can be provided. Industrial Equipment Division, The Master Electric Co., Dayton, Ohio.

### Starters

"De-ion Motor Watchman" manually operated across-the-line starters, for controlling grinding wheels, drill presses, fans, pumps, blowers, riveting and stapling machines, is available in 2 sizes—for motors up to 2 hp., for motors up to 7½ hp. Indicating toggle switch, recessed within the cover to prevent accidental operation, indicates "on," "off," or "tripped" position. Snap-action bi-metal disk that is trip-free, gives overload protection and automatically disconnects the motor from the line before heat can damage the windings, it is claimed. Safety interlock prevents the cover from being opened unless the switch is in "off" position. Non-warping, non-carbonizing porcelain arc box and base has been designed for operation under high humidity conditions. Provision for conduits is made on top, sides, bottom, or back of case. Units are available with dustproof, watertight, explosion-resisting, or flush-type inclosure features. Westinghouse Electric & Mfg. Co., Dept. 7-N-20, East Pittsburgh.

### Chain

Hardened steel chain is made from mild steel bars treated with a special hardening process, producing units of long wear-

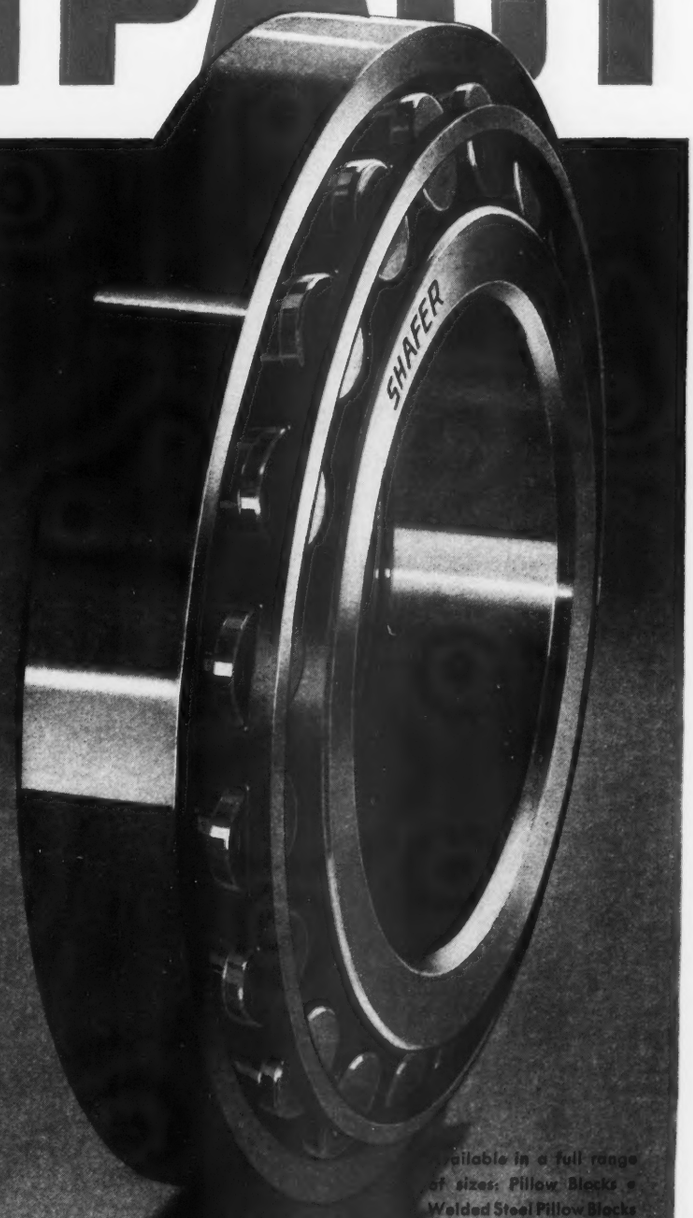


ing qualities in uniform tensile strength. Cast alloy connecting couplers are inside and protected by the hardened links. Carrying surface is entirely closed to prevent nails, or other irregularities of the commodities, from catching. All edges of the chain are beveled or rounded for smooth performance. Standard Conveyor Co., North St. Paul, Minn.

### Manual Control

"Rheotrol" manual control, for balancing heating rate of electrically operated furnaces, ovens, heaters, kilns, is designed without step control to give the operator control over any temperature in the furnace range. An adjustable input controller, it substitutes power-consuming resistors with rotating cams operating switches to effect make-and-break control. Adjustment is accomplished by variable-ratio settings of the rotating cams. "On-off" control of heating rate is effected once every minute inter-

# COMPACT




Shafer roller bearings, with their self-alignment and radial-thrust capacity, inherent features of the concave roller—convex raceway design, provide generous capacity in compact installations. Shafer gives you "everything you need in a roller bearing"—without unnecessary bulk or weight.

**SHAFER BEARING CORPORATION**
35 East Wacker Drive
Chicago Illinois

...ailable in a full range of sizes: Pillow Blocks • Welded Steel Pillow Blocks • Flange Units • Take-up Units • Hanger Boxes† • Cartridge Units • Flange-Cartridge Units • Duplex Units • Conveyor Rolls • Radial-thrust Roller Bearings

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CONCAVEX

**SHAFER *Self-Aligning* ROLLER BEARINGS**

*Why* CYCLONE is the Largest-Selling
Property-Protection Fence in the World

THOUSANDS of plant owners have found that the best way to cut down property losses is to enclose their entire plant with sturdy Cyclone Fence. Cyclone limits entrance and exit to conveniently located gates. Burglars know that Cyclone Fence is too tough a barrier to fool with—that the barbed wire top means business. And should they get in, the fence spoils their get-away.

The wide use of Cyclone for property protection is largely due to its reputation for long service. Cyclone requires practically no upkeep. Heavy galvanizing protects the mesh and all parts from weathering. Posts are strong and straight—firmly embedded in concrete bases that frost won't budge. Expansion joints keep rails from buckling. Cyclone gates swing freely on rugged ball-and-socket hinges.

Find out for yourself how you can protect every foot of your property line. Call in a trained Cyclone engineer. His services are yours for the asking. He'll help you work out your protection problems and gladly give you a free estimate. You'll be surprised to find out how little it costs per year to have this valuable protection.

*Now you can be sure of the quality of fence before you buy it. Cyclone Fence with the "12M" label has an extra-heavy coat of galvanizing that resists rust and makes the fence last longer. Be sure that the "12M" label is on the fence you buy.*

CYCLONE FENCE COMPANY
General Offices: Waukegan, Ill.
Branches in Principal Cities
Standard Fence Company, Oakland, Calif., *Pacific Coast Division*
United States Steel Products Company, New York, *Export Distributors*

**MAIL COUPON FOR FREE BOOK ON FENCE**

Send for this 32-page book. Tells you all you want to know about fence. Packed with valuable fence information and illustrations. Describes 14 kinds of fence. Tells how to select the right fence for home, school, playground or business property. Whether you need a few feet of fence or miles of it, you need this book. Buy no fence until you see what Cyclone has to offer. Mail the coupon today.

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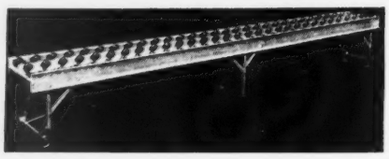
Waukegan, Ill.
Please mail me, without obligation, a copy of "Your Fence—How to Choose It—How to Use It."
*Name*.....
*Address*.....
*City*..... *State*.....
I am interested in fencing: ☐ Industrial Property; ☐ Playground; ☐ Residence; ☐ Estate; ☐ School. Approximately.....feet.

UNITED STATES STEEL


val, as determined by the dial setting. Model 680: contact load capacity, non-inductive rating—10 amp., 110 volts; 5 amp., 220 volts. Model 684: contact load capacity—35 amp. a.c. non-inductive, 110 or 220 volts. Both models operate on 60 cycles but may be ordered for 25 cycles. Wheelco Instruments Co., 1929–33 South Halstead St., Chicago.



### Portable Aluminum Conveyor

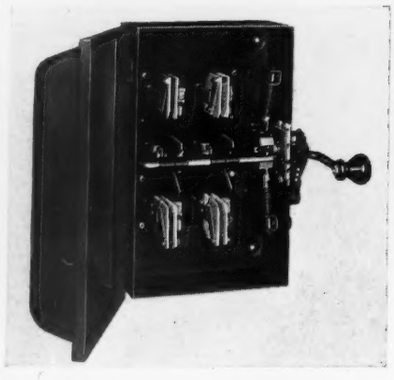
Roller-type portable conveyor is made of aluminum for light weight. Has steel ball-bearing wheels fitted on eccentric axles at each end. When wheels are in "down" position the conveyor is easily rolled from place to place; when they are "up," the conveyor rests firmly on the floor. It is said to incorporate rugged construction and be able to support heavy loads. Can be supplied with or without legs and with or without wheels on the legs. Available in various widths, lengths, and heights. Aluminum Ladder Co., 122 Adams St., Tarentum, Pa.

### Single-Phase Motors

Type BSF single-phase motor, sizes ¾ to 3 hp., has single-phase-type stator and connected double voltage (110 and 220 volts). The rotor is provided with buried squirrel cage under a repulsion rotor winding, a commutator and brushes. The squirrel cage windings are not effective at locked and low-speed operation but become effective as the motor speed approaches synchronism. They are suited to loads having long accelerating time. Type BS, available from ⅛ to 1 hp., are repulsion-start, induction-run motors for general applications. Rotors have one winding only connected to a commutator. At a predetermined speed the centrifugal short-circuiting device shorts the segments and lifts the brushes off the commutators. Stators are connected for double voltage, 110 and 220 volts. Capacitor motors are available in a number of types. Sterling Electric Motors, Inc., 5401 Telegraph Road, Los Angeles.

### Socket Set

No. TD4 ⅜-in. square drive socket set contains 38 pieces. It can handle all hexa-



# Belting Costs Dive with Condor TRANSMISSION BELTS on YOUR Drives...

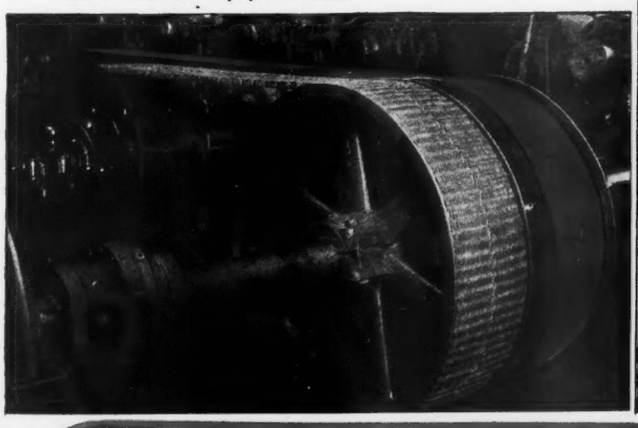
**CONDOR COMPENSATED**—the belt with equalized ply stresses—cuts power and maintenance costs on heavy-duty, high-speed flat belt drives. It's compensated so that each ply bears its share of the load as the belt flexes around the pulley. This patented Manhattan construction eliminates ply rupture and separation, and fastener troubles . . . increases belt life and efficiency. Condor Compensated has 12 advantages—all are explained in Bulletin 6808. Write for your copy.

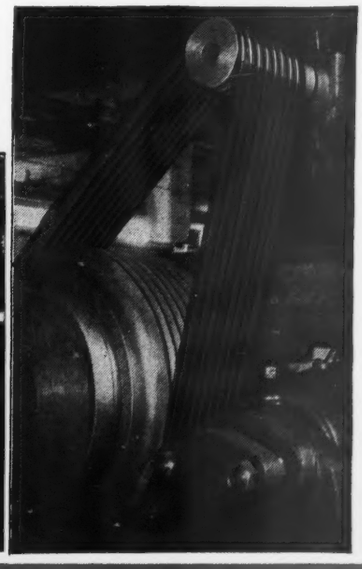
**CONDOR WHIPCORD V-BELTS**—On light- and heavy-duty, short-centered drives, Condor Whipcord V-Belts grip the pulley regardless of load variations. They are kept flexible, strong, free from stretch by Manhattan's 8-Point Balanced Construction which minimizes destructive internal heat, structural breakdown and side-wear. Bulletin 6868 describes Manhattan's original V-belt design and construction in detail.

**CONDOR WHIPCORD ENDLESS BELTS**—Highly flexible, strong, free from stretch, Condor Whipcord Endless Belts take the punishment of high-speed, high-tension operation over small or large pulleys. They are made in six styles to meet nearly all requirements for endless flat belt drives. Send for Bulletin 6869.

This 8-inch, 7-ply Condor Compensated Belt in large paper mill has never been taken up or removed from pulleys in five years. Belt is 32 feet, 10 inches long and operates on a Pulmax Drive.

Condor Whipcord Endless Belt on a helper drive at wet end of paper machine.





8 Condor Whipcord V-Belts on a large lathe.

THE MANHATTAN RUBBER MFG. DIVISION
OF RAYBESTOS-MANHATTAN, INC.
*EXECUTIVE OFFICES AND FACTORIES*
33 Townsend St., Passaic, N. J.

# DRIVE PHILLIPS Recessed Screws with "YANKEE"

## QUALITY SCREW DRIVERS

*— Two Styles —*
**HEAVY DUTY**
*and*
**REGULAR**

**HEAVY DUTY**
No. 901–1 Point
No. 902–2 Point
No. 903–3 Point
No. 904–4 Point

**REGULAR**
No. 941–1 Point
No. 942–2 Point
No. 943–3 Point
No. 944–4 Point

## "YANKEE" PHILLIPS BITS *for use in all* "YANKEE" SPIRAL SCREW DRIVERS



No. 1 POINT
No. 2 POINT
No. 3 POINT

PHILLIPS LIC. S Patent Nos. 2046837-2046840-2066372.

**"Yankee" Phillips screw driver blades and bits are of special alloy steel; the best obtainable for the purpose. They are hardened and tempered to the proper degree for the driving of Phillips Screws, including the sheet-metal, self-tapping types of screws which are being used very extensively.**

***Write us for further details.***

**NORTH BROS. MFG. CO.**
**Dept. F Philadelphia, U.S.A.**


gon bolts and nuts from $\frac{5}{8}$ in. to $\frac{7}{8}$ in. Includes 11 double hexagon sockets, four double square sockets, four double hexagon flexible sockets, eight extra-deep double hexagon sockets, universal joint, four extensions (3, 6, 12 and 17 in. long), speeder, drag link socket, hinge handle, cross handle, reversible ratchet and sliding "T." All pieces are made of chrome vanadium steel packed in a metal box. Bonney Forge & Tool Works, Allentown Pa.

### Carbide Cutting Metal

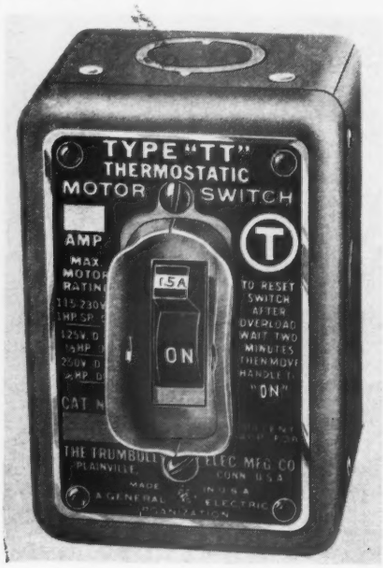
Grade 78 is a special carbide containing a combination of tungsten, tantalum, and titanium carbides. It is used for taking cuts as heavy as $\frac{3}{8}$ in. with feeds up to $\frac{3}{64}$ in. per revolution in the machining of steel bars and castings. Carboloy Co., Inc., 11185 East 8 Mile Road, Detroit.

### Oil Filter

Type T-1 oil filter is designed for protection of bearings used on grinders, automatic screw machines, and other machine tools. It removes all solid impurities such as fine metal chips from the oil. Unfiltered oil enters through optional vertical or horizontal inlets and flows into a drawn steel case. It is then forced through an "Igneonite" filtering element and enters the brass collector tube, from which it passes through an annular passage to be discharged through optional outlets. There is a drain cock for draining accumulated dirt and water from the sump. AC Spark Plug Division of General Motors Corp., Flint, Mich.

### Starter

Type "T.T." thermostatic starter provides control and overload protection for a.c. or d.c. motors of 1 hp. or less. This manual starter is manufactured in both single and double pole, and provides quick-make and quick-break of its silvered contacts. Plastic case incloses entire starter mechanism. Flush or surface mounting. The Trumbull Electric Mfg. Co., Plainville, Conn.





## *Everything You Need* for Low-Cost FLOOR CARE

**43 sizes and types of equipment from which to choose, and a complete line of accessories, waxes, sealers, cleansers. Finnell serves *every* phase of floor care for *every* type of floor.**

**See what Finnell can save you. Free floor survey involves no obligation. Phone nearest Finnell branch, or write:**

**FINNELL SYSTEM, Inc.**
**2509 East St. Elkhart, Ind.**

**Fairbanks Commander Steel-frame Platform Trucks withstand more rough treatment, therefore give years more service.**

**Why? Because the ruggedly constructed hardwood platform is protected all around by heavy steel angle irons. But in case of accident, one or all platform boards can be easily and cheaply replaced without cutting or rewelding.**

**Handles and wheels can also be replaced or changed.**

**They're made in styles and sizes for practically every service. Write for Catalog No. 52.**

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**401 Lafayette St. New York, N. Y.**
Boston, Pittsburgh
Distributors in Principal Cities
Factories: Binghamton, N. Y. Rome, Ga.

**Fairbanks**
PLATFORM TRUCKS

# what a PHILLIPS SCREW thinks about

Well, I just got driven home as smoothly and comfortably as though I were riding in a limousine.

A short while ago I was in a box with some other Phillips Recessed Head Screws and then this fellow picked me up and tucked me onto the end of a driver. I hung on for dear life, and even when he reached downward to get into driving position, I didn't fall off. No ending up in a trash can for me.

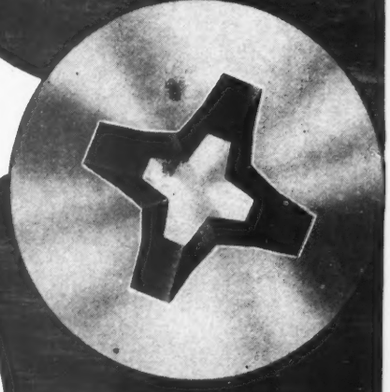
The power driver turned pretty fast, but I kept on the straight and narrow, refusing to go crooked. It didn't hurt a bit. The tapered driver fit so snugly into the recess that the operator didn't have to use much pressure. I went through the material as though it were butter.

Despite the dizzy pace, I didn't lose my head (of course, my family are famous for keeping their heads about them), and there was none of the shearing action that causes burrs on slotted screws.

So here am I, safe and sound, and up to my neck in work. I have a secure grasp on things and I'm certainly not the type to go on the loose. And if anybody says I'm *tight*, that's all right because I *am* tight. And if *you* want to be tight with *money*—I'd advise you to look up the rest of my family. Our coat of arms reads, you know, "It Costs Less to Use Phillips Screws."

P.S. You can get some pretty interesting information on how thousands of firms have lowered assembly costs. Write for free folder to any of the firms listed below. No obligation.

*If you knew*
**YOU MIGHT CHANGE YOUR MIND ABOUT FASTENING COSTS**



This Booklet will help your plant to cut fastening costs and improve assemblies. Address one of the firms below for free copy.

# PHILLIPS RECESSED HEAD SCREWS

MACHINE SCREWS · SHEET METAL SCREWS · WOOD SCREWS · STOVE BOLTS

U. S. Patents on Product and Methods Nos. 2,046,343; 2,046,837; 2,046,839; 2,046,840; 2,082,085; 2,084,078; 2,084,079; 2,090,338. Other Domestic and Foreign Patents Allowed and Pending.

AMERICAN SCREW CO., *Licensor*
Providence, R. I.

CHANDLER PRODUCTS CO.
Euclid, Ohio

CONTINENTAL SCREW CO.
New Bedford, Mass.

CORBIN SCREW CORP.
New Britain, Conn.

THE LAMSON & SESSIONS CO.
Cleveland, Ohio

NATIONAL SCREW & MFG. CO.
Cleveland, Ohio

PARKER-KALON CORP.
New York, New York

PHEOLL MFG. CO.
Chicago, Illinois

RUSSELL, BURDSALL & WARD BOLT & NUT CO.
Port Chester, N. Y.

SCOVILL MANUFACTURING CO.
Waterbury, Conn.

**IT COSTS LESS TO USE PHILLIPS SCREWS**

**DRIVE PHILLIPS Recessed Screws with "YANKEE"**

**QUALITY SCREW DRIVERS**

*— Two Styles —*
**HEAVY DUTY** *and* **REGULAR**

**HEAVY DUTY**
No. 901–1 Point
No. 902–2 Point
No. 903–3 Point
No. 904–4 Point

**REGULAR**
No. 941–1 Point
No. 942–2 Point
No. 943–3 Point
No. 944–4 Point

**"YANKEE" PHILLIPS BITS** *for use in all* **"YANKEE" SPIRAL SCREW DRIVERS**




PHILLIPS LIC. S Patent Nos. 2046837-2046840-2066372.

"Yankee" Phillips screw driver blades and bits are of special alloy steel; the best obtainable for the purpose. They are hardened and tempered to the proper degree for the driving of Phillips Screws, including the sheet-metal, self-tapping types of screws which are being used very extensively.

*Write us for further details.*

**NORTH BROS. MFG. CO.**
**Dept. F Philadelphia, U.S.A.**


gon bolts and nuts from $\frac{5}{16}$ in. to $\frac{7}{8}$ in. Includes 11 double hexagon sockets, four double square sockets, four double hexagon flexible sockets, eight extra-deep double hexagon sockets, universal joint, four extensions (3, 6, 12 and 17 in. long), speeder, drag link socket, hinge handle, cross handle, reversible ratchet and sliding "T." All pieces are made of chrome vanadium steel packed in a metal box. Bonney Forge & Tool Works, Allentown Pa.

### Carbide Cutting Metal

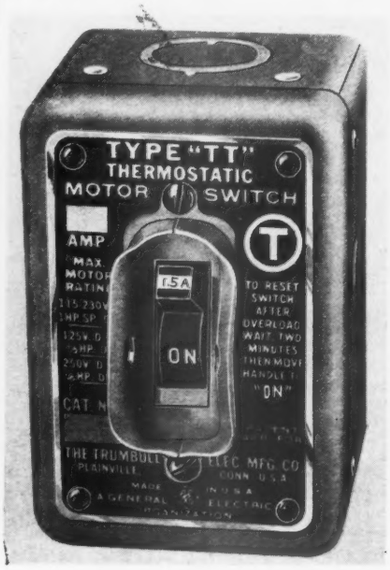
Grade 78 is a special carbide containing a combination of tungsten, tantalum, and titanium carbides. It is used for taking cuts as heavy as $\frac{3}{8}$ in. with feeds up to $\frac{3}{4}$ in. per revolution in the machining of steel bars and castings. Carboloy Co., Inc., 11185 East 8 Mile Road, Detroit.

### Oil Filter

Type T-1 oil filter is designed for protection of bearings used on grinders, automatic screw machines, and other machine tools. It removes all solid impurities such as fine metal chips from the oil. Unfiltered oil enters through optional vertical or horizontal inlets and flows into a drawn steel case. It is then forced through an "Igneonite" filtering element and enters the brass collector tube, from which it passes through an annular passage to be discharged through optional outlets. There is a drain cock for draining accumulated dirt and water from the sump. AC Spark Plug Division of General Motors Corp., Flint, Mich.

### Starter

Type "T.T." thermostatic starter provides control and overload protection for a.c. or d.c. motors of 1 hp. or less. This manual starter is manufactured in both single and double pole, and provides quick-make and quick-break of its silvered contacts. Plastic case incloses entire starter mechanism. Flush or surface mounting. The Trumbull Electric Mfg. Co., Plainville, Conn.





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**2509 East St. Elkhart, Ind.**

**Fairbanks Commander Steel-frame Platform Trucks withstand more rough treatment, therefore give years more service.**

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# what a PHILLIPS SCREW thinks about

Well, I just got driven home as smoothly and comfortably as though I were riding in a limousine.

A short while ago I was in a box with some other Phillips Recessed Head Screws and then this fellow picked me up and tucked me onto the end of a driver. I hung on for dear life, and even when he reached downward to get into driving position, I didn't fall off. No ending up in a trash can for me.

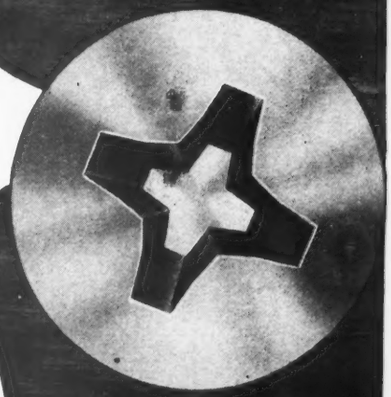
The power driver turned pretty fast, but I kept on the straight and narrow, refusing to go crooked. It didn't hurt a bit. The tapered driver fit so snugly into the recess that the operator didn't have to use much pressure. I went through the material as though it were butter.

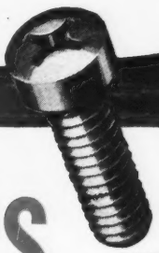
Despite the dizzy pace, I didn't lose my head (of course, my family are famous for keeping their heads about them), and there was none of the shearing action that causes burrs on slotted screws.

So here am I, safe and sound, and up to my neck in work. I have a secure grasp on things and I'm certainly not the type to go on the loose. And if anybody says I'm *tight*, that's all right because I *am* tight. And if *you* want to be tight with *money*—I'd advise you to look up the rest of my family. Our coat of arms reads, you know, "It Costs Less to Use Phillips Screws."

P.S. You can get some pretty interesting information on how thousands of firms have lowered assembly costs. Write for free folder to any of the firms listed below. No obligation.

*If you knew*
**YOU MIGHT CHANGE YOUR MIND ABOUT FASTENING COSTS**





This Booklet will help your plant to cut fastening costs and improve assemblies. Address one of the firms below for free copy.

## PHILLIPS RECESSED HEAD SCREWS

MACHINE SCREWS · SHEET METAL SCREWS · WOOD SCREWS · STOVE BOLTS

U. S. Patents on Product and Methods Nos. 2,046,343; 2,046,837; 2,046,839; 2,046,840; 2,082,085; 2,084,078; 2,084,079; 2,090,338. Other Domestic and Foreign Patents Allowed and Pending.

AMERICAN SCREW CO., *Licensor*
Providence, R. I.

CHANDLER PRODUCTS CO.
Euclid, Ohio

CONTINENTAL SCREW CO.
New Bedford, Mass.

CORBIN SCREW CORP.
New Britain, Conn.

THE LAMSON & SESSIONS CO.
Cleveland, Ohio

NATIONAL SCREW & MFG. CO.
Cleveland, Ohio

PARKER-KALON CORP.
New York, New York

PHEOLL MFG. CO.
Chicago, Illinois

RUSSELL, BURDSALL & WARD BOLT & NUT CO.
Port Chester, N. Y.

SCOVILL MANUFACTURING CO.
Waterbury, Conn.

**IT COSTS LESS TO USE PHILLIPS SCREWS**

**Budgeting for Profit**

*(Continued from page 56)*

decrease in some other segment. Thus, if selling expense increases, and net is to remain unchanged, some other expense ratio must be decreased by a corresponding amount.

We have tried to emphasize the point that a comprehensive budget system must be completely tied together. In connection with the sales dollar illustration we can carry this concept further by removing one segment of that pie chart, for example, manufacturing cost, and enlarging it so that it becomes a complete unit in itself (Figure 4); one department of this division is in turn broken down into the expenditures by account (Figure 5).

*We Help Our Foremen Become Better Managers*—While upper limits are placed upon the expenditure within each functional unit of the organization, the department heads are definitely co-authors of their budgets. We feel that the success of our budget plan rests largely on the cooperation we gain from the department managers and foremen by our working with them in the construction of their own budgets. By centralizing responsibility in the foreman, we have increased the interest that he takes in each cost element as reflected against his department. He regards it as a guide, not a restriction; it sets goals of possible achievement and objectives which we believe offer him a challenge to develop new processes and methods which will bring about continued reductions in unit cost.

The value of giving the foreman an active part in making up his budget is brought out forcefully when the first monthly actuals are released. If he has had his share in building up the budget for his department, he will not be shocked at seeing in black and white a break-down of all allowable expenses for the next twelve months. By this time he has been convinced of the fairness of the budget figure allocated to him, and is not only ready to try to attain his objectives but will also endeavor to better his operation results.

It has often amused all of us to notice how interested a person is in all the points of his recovery after being ill for a while. Temperature, pulse, the room, and his own appearance are subjected to minute inspection. We have found practically the same reaction in the functioning of our budget. After the first month's actual performance figures had been presented and he had a chance to see exactly how much he had exceeded or expended less than his budget just where and in what accounts, a definite interest grew. The budget became his thermometer of department health.

*Unfavorable Trends Quickly Indicated*—Our management is able to keep its activities focused on the established profit, sales, and expense trends through the monthly comparison of the operations with predetermined budgets. Whenever these controls indicate that immediate action is necessary, management is able to place its finger on the individual department head and expense account that is in trouble. In this way we avoid the usual buck passing due to dual or multiple responsibility for an expenditure.

Another over-all control which we have found particularly useful has been average unit value. As a check against changes in expense or income trends, unit cost is built up in the profit and loss schedule on the operating accounts. It is possible to show over a period of months and years how many cents per unit is spent for selling and distribution, taxes, administrative control, etc. This control is of particular importance in connection with any decision as to

REDUCE CYLINDER WEAR •
REDUCE OIL FEED •
PROTECT AGAINST SEIZURE •
IMPROVE VALVE OPERATION •
with dag
REG. U.S. PAT. OFF.
COLLOIDAL GRAPHITE
In all equipment lubricated with oil containing "dag" colloidal graphite, the advantages resulting come from the formation of smooth, self-lubricating graphoid surfaces on the friction parts.
Air compressors are no exception. Better piston seal and less wear can be expected. "Dag" being unexcelled as a high temperature lubricant, the value of this surface when high compression is undertaken is evident.
Furthermore, the "dag" formed graphoid surface enables the oil-feed to be cut materially. Reduction in the amount of oil vapor present and in the formation of carbon naturally follows.
A request on your letterhead will bring an inspection sample and Bulletin No. 112 describing the running-in of mechanical devices with "dag" colloidal graphite.
Your oil supplier can easily add "dag" to your present lube or to specially selected petroleum fluids.
ACHESON COLLOIDS CORPORATION
PORT HURON, MICHIGAN
dag
COLLOIDAL PRODUCTS

# IT'S EASY TO SEE WHETHER THIS STARTER IS on-off OR tripped

## New "De-ion" Starter for Motors up to 7½ hp

This new manual starter, the Westinghouse Motor Watchman, has an indicating handle on the front of the starter. It shows the operator or inspector at a glance whether the starter is tripped, on, or off. Smaller, more compact, it is easily mounted on or near the machine. Saves time . . . saves guessing . . . saves space.

**You get all these advantages only in the new Motor Watchman**

- Westinghouse "De-ion" Arc Quenchers protect contacts from flashovers . . . prolong contact life.
- Snap action bi-metal disc relay protects motor from overload. Resets to correct calibration — nothing to replace.
- Safety interlock prevents accidental contact with live parts.

For complete data, ask your nearest Westinghouse office, electrical wholesaler or industrial agent.

**WESTINGHOUSE ELECTRIC & MANUFACTURING CO.**
**East Pittsburgh, Pa.**

J-20847

# Westinghouse
# "De-ion" Motor Watchman

W
WESTINGHOUSE ELECTRIC

price policy. If a reduction is to be made in the unit price, how it will affect fixed charges per unit, and what percentages of increased sales will be required to take up the slack, are some of the questions on which it has a definite bearing.

*The Forward Outlook of the Complete Budget Aids Management*—Factory management has long realized the additional economies to be had through improved planning for projected periods of six to twelve months in advance. Factory management, however, to date has not been able to find as effective a method of obtaining the necessary data for long-term planning as is available in a complete financial budgetary program. Quite naturally the objective is toward a satisfactory customer indication as to his requirements for a considerable period in advance of actual order placing. Not only can daily operation costs be reduced through long-term planning, but capital and equipment expenditures can also be made on a more economical basis when the over-all market potentials are fairly well established and all management works toward the same end.

In other words, the rapid strides our company has made and will continue to make for years to come is aided by the marshaling of all possible tangible and intangible potentials and reducing them to a projected financial program termed the financial budget.

We believe that a great portion of the success of our budget has been due to the fact that it is a complete budget covering *all* activities of the company. Budgets covering only certain phases of activity enlist the support of only certain groups of the organization and fail to coordinate the activities of the various divisions. The complete budget coordinates all functions for the accomplishment of the desired long-term profit goal and enlists the whole-hearted support of management to achieve it.

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Guide to Treatment Shipped with Steel

**Thousands of steel buyers are now enjoying the time and money saving features of the Ryerson Certified Alloy Steel Plan. They get carefully selected alloys which have all hardening factors (analysis, grain size, etc.) within a very narrow range. With every shipment, large or small, Ryerson sends accurate data on heat treatment response, and chemical and physical properties. There is no need to test, or experiment in order to secure desired results. You too can have this valuable data. It is given without additional cost or obligation. Simply specify Ryerson Certified Alloy Steels on your next requisition. Immediate Shipment will be made from large and complete stocks of these accurately identified, known quality steels. Ryerson Certified Steels also include carbon, tool and stainless steels. Write for the Ryerson Stock List, which gives data on all Ryerson Certified Steels.**

Joseph T. Ryerson & Son, Inc., Chicago, Milwaukee, Philadelphia, St. Louis, Cincinnati, Detroit, Cleveland, Boston, Buffalo, Jersey City.

RYERSON CERTIFIED STEELS

RYERSON


## Short Runs Go Straight-Line

*(Continued from page 51)*

tion in which the piece fails to fit and the error is discovered.

Supervision and production control have also found benefits in straight-line production—the foreman, because it is easier to supervise a number of successive operations on the same model than the same number of similar operations on different models; the production department, because it is unnecessary to chase material from operation to operation once it has been delivered to the line.

The basis of the straight-line technique is a thin, rapidly moving stream of work. Interruption of this stream results in lost time for the entire line. This was startlingly evident during our first experiments. Errors or delays in engineering, planning, tool and fixture construction, maintenance, and scheduling, which in departmentalized manufacture delayed only a few men, created minor crises and stopped from 16 to 30 men in straight-line operations. It was obvious that in these departments performance standards which might be passable or at least tolerable in departmentalized manufacture would be inadequate for straight-line operation. It would be difficult to overemphasize the importance of developing a hard-hitting service organization before attempting this type of manufacture.

The necessity of frequent rearrangement of the production line in this type of industry has already been discussed. We found the actual moving of the machines a simple matter compared with that of connecting them to power-supply and dust-collection systems.

We solved the power problem by hanging in the center of the manufacturing area a run of three-pole busbar enclosed in a metal duct containing

# Out of the Witch's Cauldron comes *trouble* for turbine bearings

Air—water—catalysts—heat—pressure. That's the beating a turbine oil must take. To build a product that can stand such treatment *at all* is an accomplishment. But to put the proper grade in service, check it and watch it, and *keep it in service* for months and years until it pays for its cost, is the job Shell undertakes.

First there's the oil itself: Shell Turbo Oil. Research and refining, tied in with the experience of turbine builders and users, have produced an oil of unusual stability.

Next, Shell realizes operating variables require that even the finest oil be given every chance to succeed. **Hence Shell has created a staff of experienced engineers—thoroughly capable of giving *real help*, not their mere presence, to turbine manufacturers and users.**

And the Shell product and plan are working. We have enjoyed a substantial increase in business and gained the confidence of technical staffs in this field from coast to coast.

SHELL

# SHELL TURBO OIL

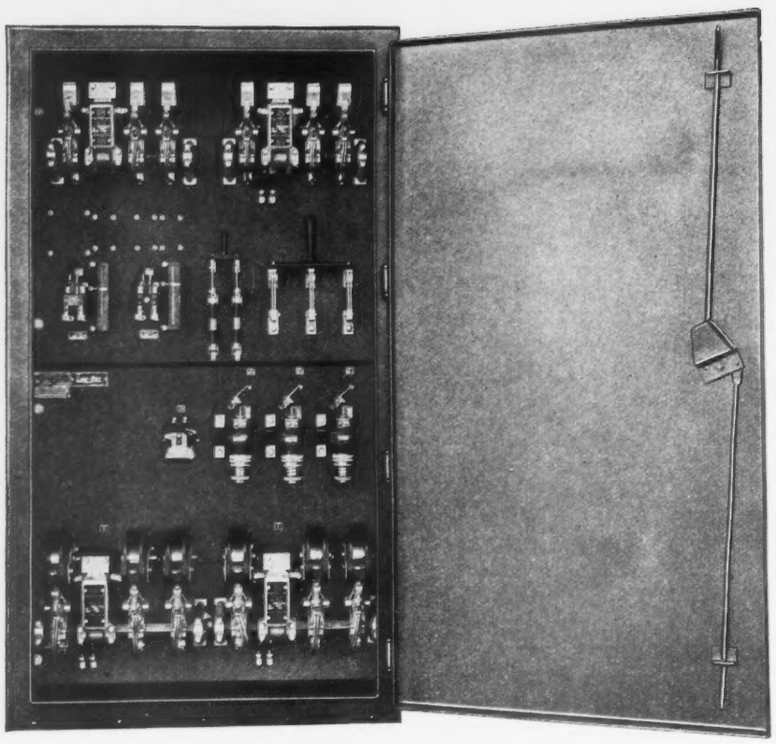
openings at 1-ft. intervals. These openings are closed by hinged cover plates when not in use. Each machine to be used in the area is equipped with a fused plug connected to the machine by a length of four-wire rubber-covered cable. This plug bolts to the duct and grips the busbar through the duct openings with heavy spring clips.

When a machine is to be moved its plug is removed from the duct, the hinged cover is swung over the duct opening, and machine and plug are moved to the new location where the duct cover is swung aside and the plug reconnected. Current for 110-volt single-phase tools, glue heaters, and localized lighting is supplied through two "reach high" runs of two-pole duct in which plugs and collector trolleys may be inserted.

Dust collection is provided by mains over the manufacturing area with blast-gate-equipped 6-in. nipples at 3-ft. intervals along each main. The machines are equipped with a length of flexible metal hose which clamps to the nipple of the main. Each machine is equipped with hose of the size its hooding requires. If the hose is less than 6 inches in diameter, it is fitted with a reducing nipple to hook it to the main nipple.

These facilities effect an important reduction in the two most costly factors of machine rearrangement, and do much toward making straight-line production feasible in our plant for short runs.


# EC&M CONTROLLER for WOUND ROTOR MOTOR



**Used on a Sheet Stretcher Drive,** this EC&M Frequency Relay Magnetic Controller offers an outstanding advantage.

On a machine of this type, using motor-drive to remove wrinkles and draw the sheet taut with stretching done hydraulically, travel is short so that the motor quickly reaches a stalled condition. Under stalled conditions with accelerating resistance cut out of the circuit, a wound rotor motor develops low torque with high current.

On this application as the motor slows down or jams, the EC&M Frequency Relay Controller automatically increases motor torque by automatically notching back to re-insert resistance in the rotor circuit to provide the proper torque.

Folder 930, describing Frequency Relay Control, points out many other interesting applications of this new system of control. Write for your copy today.

THE ELECTRIC CONTROLLER & MFG. CO. E&M CLEVELAND, OHIO

HEAVY DUTY MOTOR CONTROL FOR CRANES, MILL DRIVES AND MACHINERY • BRAKES • LIMIT STOPS • LIFTING MAGNETS AND AUTOMATIC WELD TIMERS.


## Teaching Supervisors To Think

*(Continued from page 63)*

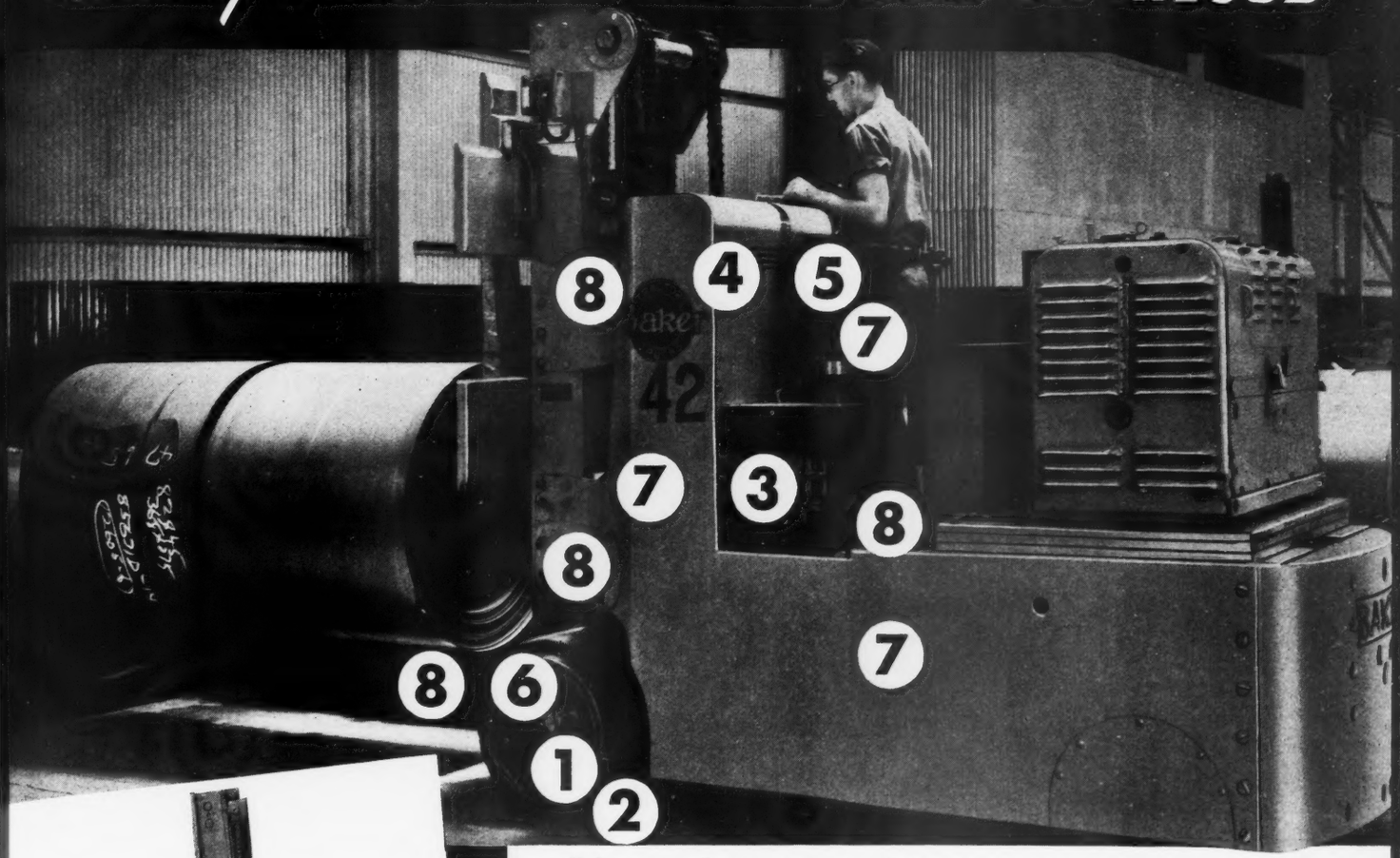
to the foreman, "It is a good time for you and me to consider whether we are the kind of supervisor we should like to have if we were the workers." Emphasis was placed upon ways and means by which a supervisor could make practical application of the subject matter in his daily contact with the men.

It is difficult to give the gist of a whole winter's program in a few sentences. However, from the broad aspect of social relations we developed the thought that everyone is responsible for proper human relations. Different types of employees were mentioned and methods of contacting them discussed. We wanted to establish the point that the supervisor has to consider the other fellow's point of view and approach him in the light of his experiences and methods of thinking. To summarize this section, several case problems taken from our own experience in the shop were thrown into the group, and the group's solutions were printed as a permanent record of type cases.

Our most recent group of discussions served to elaborate the two previous ones, to emphasize departmental organization, and to bring out the necessity for the supervisor's analyzing his problems, and the means by which he could do it. Considerable attention, for example, was devoted to methods of teaching and to the giving and receiving of orders. What an order should consist of, how it should be given, and under what conditions written or verbal orders should be used, formed a part of the program. All of this is important in instructing on the job. Special emphasis was placed upon the fact that employees prefer to work with supervisors who have the ability to organize their equipment, methods, and men so that things run smoothly and orderly.

With the record of the conference solutions in the hands of the supervisors, and by their daily contact with members of the committee, tangible results of our efforts are evident in performance and in better understanding within the organization. However, with emphasis placed upon output and the meeting of shipping schedules, the supervisor is all too prone to forget the human side of his job. Following the

# At Carnegie-Illinois' Irvin Works— as at other leading mills BAKER TRUCKS STAY ON THE JOB



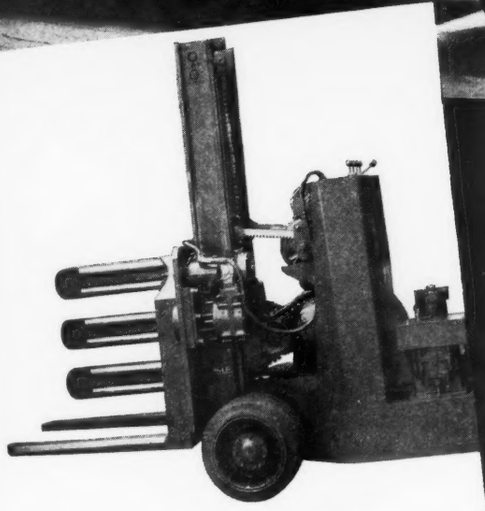

*Baker 15,000 lb. capacity ram truck in service at Carnegie-Illinois new Irvin Works.*

Carnegie-Illinois uses a fleet of Baker heavy-duty Ram Trucks for handling coils at its new continuous hot strip mill at Irvin. After nearly a year of continuous hard service, they are performing as well as the day they were installed. Similar Baker fleets at other leading steel mills, have a record of trouble-free performance under the most gruelling conditions, for over two years—proving conclusively that Baker Trucks can "take it!" Features illustrated above tell why.

*Whether you are handling flat sheets or coils, or any other materials, supplies or finished products, the Baker Material Handling Engineer can help you. Write to*

**BAKER INDUSTRIAL TRUCK DIVISION**
*of the Baker-Raulang Company*
**2178 WEST 25th STREET • CLEVELAND, OHIO**

1. The strongest drive axle ever used for industrial trucks. No failures in over 2 years of constant hard use.
2. Tire wear minimized by correct steering design. One fleet of 6 trucks reported no worn-out tires in two years of use.
3. Baker power steer holds trucks in a straight course. Easier to steer, without weaving and wandering.
4. Baker's full contactor control is positive in action and trouble-free. Contact tip replacements easily and quickly made.
5. Baker automatic accelleration means easier handling, and less operator fatigue.
6. Baker's hydraulic wheel brakes have given over 2 years of service without record of failure.
7. No maintenance other than brush adjustment or replacement needed by Baker hoist, tilt or drive motors in 2 years of use.
8. Complete accessibility of Baker units and motors means quick, easy maintenance and repair.



## Now Available...
### NEW BAKER FORK TRUCK WITH COIL UP-ENDER

Baker heavy-duty fork trucks for steel mills can now be equipped with a coil up-ender, which changes coils from horizontal to vertical or vertical to horizontal positions as desired. Other special adaptations to meet individual requirements.

Trade mark Registered U. S. Pat. Off.

# Baker

**POWER INDUSTRIAL TRUCKS FOR EVERY PURPOSE**

old precept of learning by doing, we ask him specifically to devote one hour in each working day to putting into practice what he gets out of the conference, to circulate around in his department and get better acquainted with his people, and thus come to appreciate their problems and their ways of thinking.

Attention has been focused upon the supervisor thus far, but other company training policies tend to make supervision somewhat more simple than it would otherwise be. Following a policy of promotion from within, we offer courses for shop employees to fit them for higher-rated jobs in the organization. A course for comptometer operators, as an example, is open to girls in the shop and office, and they are promoted to jobs calling for this skill as openings occur. Blueprint reading, shop mathematics, and descriptive geometry classes are likewise open to the young men as a means of preparing for the next job ahead.

These conferences will be continued. The things stressed will depend to a considerable extent upon what problems our organization will be facing at the time and upon the results of the last group of conferences.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Sixteen pages of illustrations and data to show you where and how to reduce accident hazards and to save money on the maintenance of floors, walkways, stairs and platforms.

INLAND 4-WAY FLOOR PLATE

ROLLED BY INLAND STEEL CO.

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INLAND 4-WAY FLOOR PLATE is used in many of the country's largest industrial plants and public buildings, also on numerous kinds of machinery and equipment requiring steps, platforms and floor plates.


## Cincinnati Gets the Facts on Training Needs

*(Continued from page 65)*

Thus only 80 per cent of the total unemployed, or 247, are to be considered as skilled. A further reduction must be made for age, since 39.9 per cent of the employed are 45 or more years old. Some 50, at least, of the 247 would therefore be past, or nearly past, the employment age. Even after the partially employed were added to the total, therefore, the number would not greatly exceed the replacement requirements of a single year.

With no apprentices being trained, it is evident that any substantial increase in industrial activity above the 1937 volume would absorb the unemployed and that a further increase would find the industry unprepared to make replacements. In the absence of statistics it is impossible to determine how many more unemployed were added to the roster by the recession of 1938, nor are the figures available for balancing that by any further decline in the proportionate demand for skilled workers. But this conclusion appears to be the "best guess" and it poses to Cincinnati metal trades employers this question:

Even though it may take a boom to produce a shortage, would it not be wise to regard a boom as one of the contingencies, remote though it may seem, for which industry must provide and so, accordingly, train *some* apprentices now?"

True, the industries in Cincinnati, in cooperation with the Mechanical Vocational High School and the Ohio Mechanics Institute since 1935, have encouraged a considerable amount of apprentice training. The number of apprentices in courses which are training mechanics for the machine tool industry is approximately 150 at present. The National Youth Administration is also considering plans for such courses.

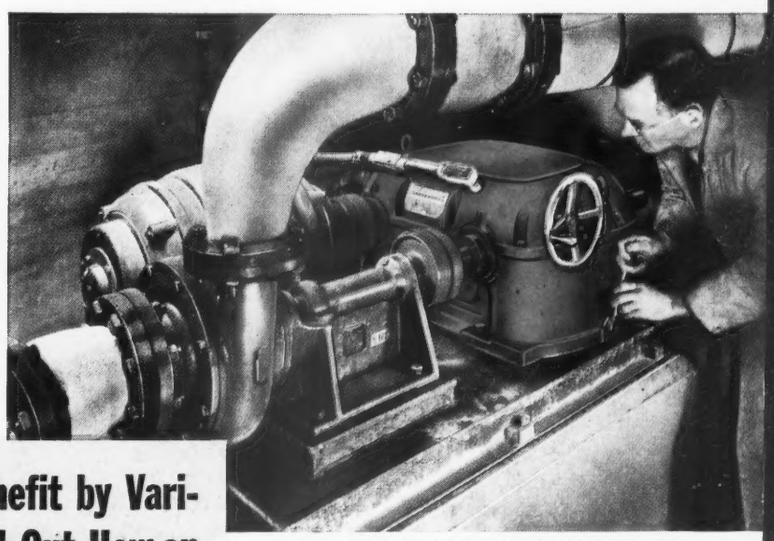
But how quickly these graduates could be fitted into industry's pattern in a "pinch" is something it might prove costly to ascertain.

If later figures were available, it might be found that Cincinnati employers have already taken steps to augment the tiny band of apprentices which the 1935 census found in their shops. This is indicated by the fact that FACTORY and *American Machinist*, in a joint survey published in FACTORY of May, 1937, ascertained that approximately 70 per cent of all the metal-working companies that replied to the questionnaire had undertaken some sort of training program. This report came on the heels of a survey by the National Industrial Confer-

*(Continued on page 130)*

# STORY OF THE VARI-PITCH SPEED CHANGER AND THE PAMPERED RATS!

*Another true case history from the Allis-Chalmers files that proves* **"IT PAYS TO BUY THE EQUIPMENT THAT PAYS FOR ITSELF!"**



ABBOTT'S RATS GET BENEFITS of this Allis-Chalmers combination! The Vari-Pitch hooked to a Lo-Maintenance Motor and A-C pump automatically increases or decreases water pressure by controlling the rpm of the pump . . . makes possible exact control of temperature and humidity.

## Abbott's Rats and Abbott's Operations Benefit by Vari-Pitch's Smooth . . . Accurate Control! Find Out How an A-C Vari-Pitch Speed Changer Can Make Your Machines More Flexible . . . Make Your Production Costs Lower!

No mother could give her children more care than Abbott Laboratories gives its white rats. No animal could have more attention. For on them Abbott tests its vitamins, serums, and drugs . . . finds out precisely their potency and safety for humans.

And when Abbott found that varying pressures in the water supply made difficult exact control of their air conditioning system . . . caused changing temperatures and humidity that actually interfered with the rats' normal appetites — they moved quick to do something about it!

They called in an Allis-Chalmers engineer from the Allis-Chalmers Chicago District Office . . . told him their problem. He rolled up his sleeves and went to work.

He hooked a Vari-Pitch Speed Changer to an Allis-Chalmers pump and motor. And because he gave them constant, positive speed control with a Vari-Pitch . . . without springs to get out of order . . . without trial or error guesswork . . . that meant the problem was licked!

For the Vari-Pitch, by accurately controlling the rpm of the pump, increases or decreases the pump pressure to the exact amount needed . . . gives Abbott the water control so necessary in their operations.

This might be an unusual application of an Allis-Chalmers Vari-Pitch Speed Changer. But the performance record it's setting for Abbott is not an unusual occurence. For Vari-Pitch is fast becoming first choice in plants in every industry that want space saving design . . . amazingly high efficiency . . . easy, instantaneous speed changes.

Be sure you know what it means to have a variable speed transmission that operates easily . . . economically . . . without the need for costly multi-speed motors or separate changeovers. For the whole story on the way Vari-Pitch can help you . . . in your plant . . . send for Bulletin B-6013.

Vari-Pitch Speed Changers • Texrope V-Belts • Duro-Brace Texsteel Sheaves • Vari-Pitch Sheaves • Standard Cast Iron Sheaves • Adjustable Pitch Diameter Texsteel Sheaves • 2-3-4 Combination Sheaves • Straitline Automatic Motor Bases • Oil Field Drilling Rigs

A-1135 Belts by Goodrich

TEXROPE DIVISION
ALLIS-CHALMERS
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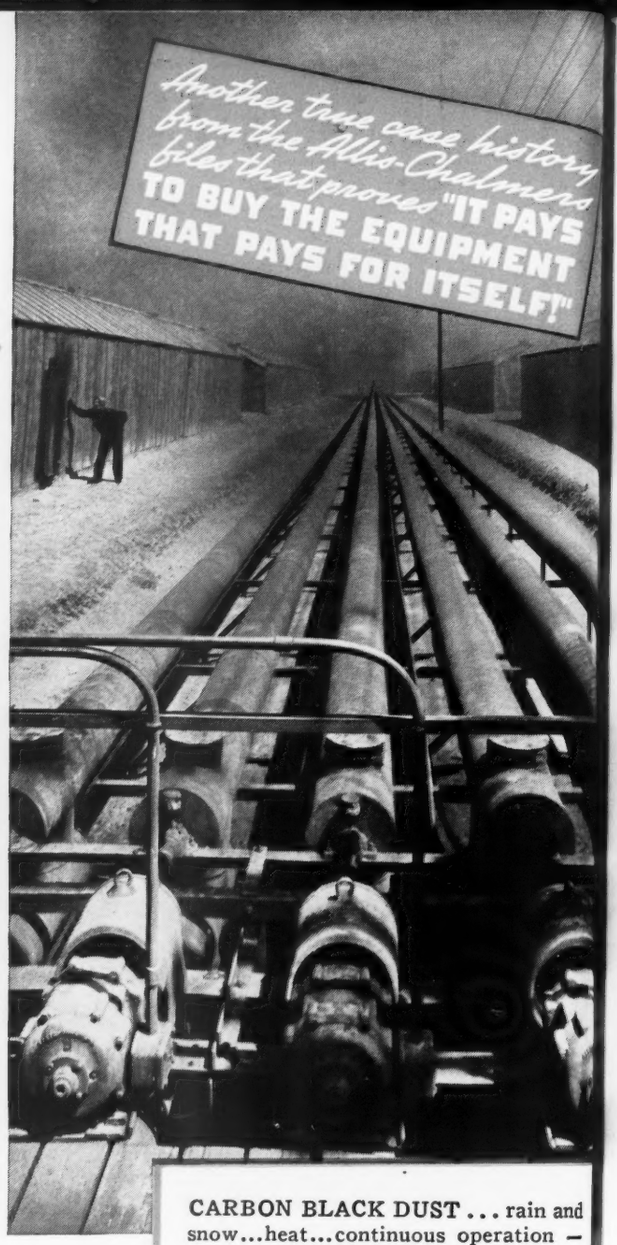
# "ALLEYS OF BLACK HELL" WHERE ONLY THE FITTEST SURVIVE!




**Allis-Chalmers Lo-Maintenance Motors Win Place as Standard Motor Equipment in the "Alleys of Black Hell" of Carbon Black Industry! Learn How Lo-Maintenance Motors Can Serve You . . . In Your Industry . . . Under the Toughest Conditions!**

"Alleyways" they call them in the carbon black industry—outdoor passage-ways where carbon black is pulverized and handled under the worst possible motor conditions!

Picture it—the air thick with carbon black dust so fine it passes through a 300-mesh screen . . . snow and rain beating down in the winter . . . great southwest dust storms bringing suffocating dust in the spring and summer . . . and the air temperature in the alleys often soaring to as high as 180° F.!

Add to this — operation that requires 24-hour-a-day motor service . . . 7 days a week . . . with the motor running one way for 8 to 10 minutes, then instantly reversing itself!

### Industry Switching to Allis-Chalmers!

Truly "Alleys of Black Hell" . . . with motor conditions so tough that the whole industry is switching to the motor that has proved it can stand up under this punishment! And that motor is the Allis-Chalmers totally-enclosed Lo-Maintenance Motor!

Why is the carbon black industry switching to Allis-Chalmers Motors? Why are hundreds of other industries coming to Allis-Chalmers for the answer to their toughest motor problems?

### Get Lo-Maintenance Facts!

It's because of the Full Measure construction that's a part of every Allis-Chalmers motor . . . the extra margin of protection and performance that gives you more than just a rated horsepower! For when you buy a Lo-Maintenance Motor, you get a motor that has built into it the results of Allis-Chalmers 90 years of progressing with industry . . . of engineering motors to drive their own line of heavy duty industrial equipment!

And combined with that are extra-value features of construction—high carbon steel frame . . . indestructible rotor and distortionless stator . . . no skimping on materials! All these work for you—help beat time-wasting shutdowns...reduce maintenance costs . . . give you years of continuous, trouble-free motor service!

**CARBON BLACK DUST . . .** rain and snow...heat...continuous operation — all unite to make conditions tough for motors in the "alleys of black hell" of the carbon black industry! That's why carbon black manufacturers today use more than 2,000 Allis-Chalmers totally-enclosed Lo-Maintenance Motors!

Learn how Lo-Maintenance Motors can save you money . . . give you better performance! Call the district office near you. Or write to Allis-Chalmers direct. A trained motor engineer will be glad to go over your motor problems with you.

MOTORS FOR ALL APPLICATIONS FROM ½ HORSEPOWER AND UP

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**AMERICAN OPTICAL COMPANY**
**SOUTHBRIDGE, MASSACHUSETTS**

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F

ence Board which showed that 78.7 per cent of all metal-working plants questioned were experiencing a scarcity of skilled help in 1937. Other signs of management's growing awareness of the problem are not lacking. In steel, the Carnegie-Illinois replacement training system (described in the October, 1937, FACTORY) is a good example. The Caterpillar Tractor Company's plan (see FACTORY, January, 1937) is another good answer to the problem, while the Detroit city-wide apprentice training plan, involving 74 firms (FACTORY, November, 1936) is designed to turn out 3,300 skilled men each year.

## Controlling Work in Progress

*(Continued from page 61)*

for commercial parts and bulk items, including large metal parts and bases.

The stock men maintain their respective sections and dispense materials to the accumulators. The accumulators assemble sets of parts in convenient multiples of the order, and place them on skids in the temporary storage area, where lines have been painted on the floors as guides to orderly storage.

Sets of parts flow to the assembly floor indicated at the right-hand edge of the layout, where several conveyors are located. In conjunction with the conveyor lines, convenient containers have been provided for ready selection of parts by the operators.

For each set of parts delivered to an assembly line, a corresponding quantity of complete assemblies is obtained by the accumulator. The complete assemblies are taken to the door of the cumulation point, where the quantity is recorded on the control chart, and the assemblies are then delivered to the finished goods storeroom.

In connection with the operation of the cumulation point, the following practical suggestions may be of value:

1. Only the personnel directly connected with the cumulation point should be allowed inside the doors.

2. To avoid excess handling of large bulk items, standard quantities should be loaded on trucks, and left on the trucks at the cumulation point without unloading.

3. Bulk parts should remain in their original cartons, and thus make accumulation easier.

4. Containers for specific parts must always contain standard quantities.

5. Methods of classifying materials for ready location should be developed, such as storing wire first by color, and then numerically.

6. Parts for small assemblies should be placed in open-mouthed containers on one skid, with the lips of all containers pointing out, along the four edges of the skid.

7. Clear aisles and good housekeeping are essential.

Up to this point our attention has been directed solely to the mechanisms and the physical layout necessary to the application of work-in-process control principles. The following outline summarizes the specific functions of the personnel involved:

*Production Office*

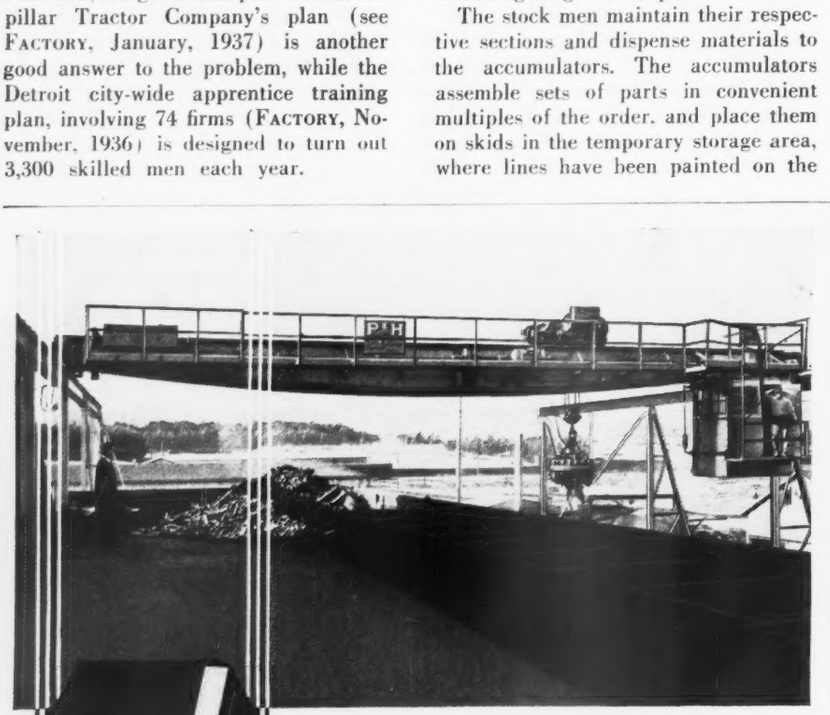
A. New Projects

1. Analyze contract for delivery and material requirements.
2. Develop project schedule.
3. Design control chart.
4. Issue control chart to cumulation point.

B. Repeat Orders

1. Compare specifications with original project.
2. Modify schedule dates in line with previous experience.

*(Continued on page 134)*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**For Service that is Time-proved and Reliable . . .**

How could you better solve your material moving requirements than through the experience of this group of specialists? During 50-odd years, P&H crane engineers have successfully answered practically every problem in overhead crane service—built more than 10,000 electric cranes. Certain standard types are available which offer you special, low-cost advantages, together with time-proved, reliable service. P&H industrial cranes are described in Bulletin C-6. Copies are available. The Harnischfeger Corporation, 4525 W. National Avenue, Milwaukee, Wis.

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**ALL FIVE FEATURES**
***when you specify***
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**rable, satin-finished Alzak Alumi-m reflector.**
**OLD LIGHT, no annoying heat radi-** Place your head or hand close to of these units and see for yourself!
**arranty of Performance and Con-ruction.**
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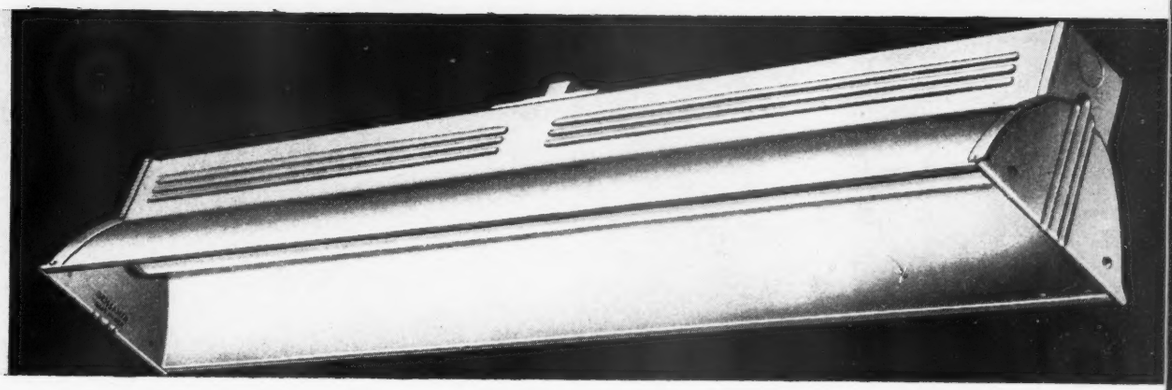
**w Cost.**



## HOW to Secure *"COLD DAYLIGHT" at Low Cost with these new FLUR-O-LINE Lighting Units!

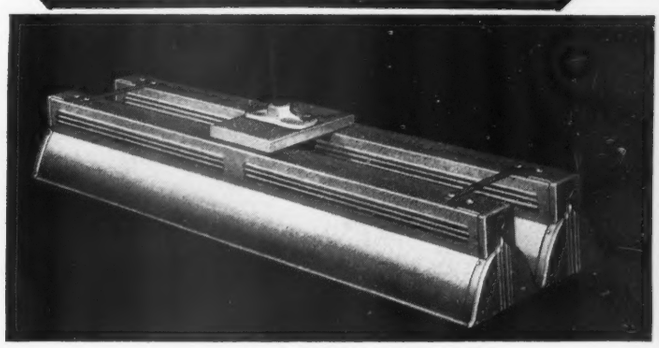
The new Benjamin Flur-O-Line units enable you to secure best results from the new Fluorescent Mazda Lamps which provide the closest approach to natural daylight at the highest efficiency ever secured from such a light source. With these new sectional type units, Fluorescent lighting may be fitted to the exact requirements of the work area. In the Flur-O-Line system, the units may be hooked up end to end to form a *long continuous line of light*, or two to six units may be connected side by side to form a wide light source.

Flur-O-Line reflector hoods consist of a highly efficient Alzak-finished aluminum reflector with which is combined a sturdy wiring channel in which can be mounted any standard type of auxiliary and capacitor. Units are available in four lengths for the 18", 24", 36" and 48" Fluorescent lamps. For complete information send for New Device Announcement No. 581. Address the Benjamin Electric Mfg. Co., Des Plaines, Illinois, U. S. A.

### WARRANTY
### of Performance and Construction

Benjamin Lighting Units for the Mazda Fluorescent Lamp are certified to comply with the requirements of *Underwriters' Laboratories Inspection Label* affixed to the unit. They are warranted by Benjamin to comply with all recognized safety requirements, illumination, electrical and mechanical standards and to give the light output efficiency and lighting performance as shown on printed specifications and tables for each type of unit. Auxiliaries supplied with these units are certified to be of the type made in accordance with specifications of Mazda Lamp manufacturers.

*Available with high power factor type of auxiliary or necessary capacitors for power factor improvement.*



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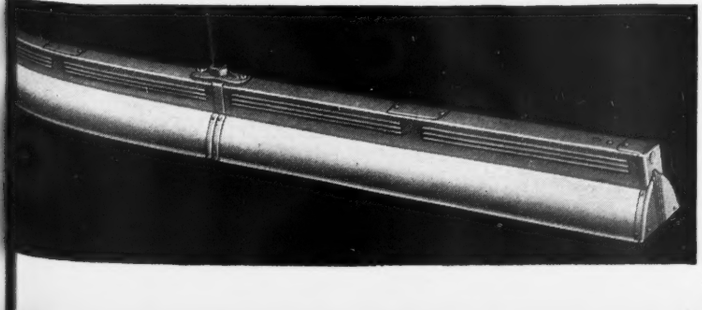
***Distributed Exclusively Through Electrical Wholesalers***



BENJAMIN ELECTRIC MFG. CO., Des Plaines, Illinois

Gentlemen: Please send me, without cost or obligation, by return mail, your New Device Announcement No. 581 containing complete information on Benjamin Fluorescent Lighting Units.

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## These Vials tell the Rice Process Story

**VIAL "A"** contains refined linseed oil as commonly used in white oil paints. Mixed with white pigments, the oil *seems* to lose its color. BUT *the yellow is still there!* Sooner or later it will show up on your painted walls and ceilings.

**VIAL "B"** shows how this oil appears after treatment with our secret Rice Process. It is almost pure white in color. *The yellow is removed!* This exclusive process is the reason why we can blend synthetic vehicles with our processed oils and give you in the new Barreled Sunlight a paint that (1) is whiter to start, (2) stays white longer, (3) dries quicker, (4) spreads and hides better, (5) flows more easily.

# SUNLIGHT DOES IT AGAIN!

**Secret Rice Process now makes Barreled Sunlight WHITER THAN EVER... keeps it white FAR LONGER... makes it for large-area work the MOST PRACTICAL QUICK DRYING PAINT AVAILABLE TODAY**

AGAIN Barreled Sunlight scoops the paint industry! Six years ago, it was the improved Barreled Sunlight . . . today it's an amazing new quick drying form of Barreled Sunlight that is even whiter to start . . . holds its whiteness far longer.

And never before has there been a paint so white, that holds its whiteness so long *and* spreads and hides so well. These outstanding improvements are made possible by our own secret Rice Process which no chemist can copy because it *defies chemical analysis.*

Only because of this exclusive process —for 25 years the secret of Barreled Sunlight's leadership—can the newer synthetic types of vehicles be combined with good old linseed oil to produce this unusual paint. It gives new ease of flow that painters like . . . that helps speed up work. It adds the important feature of *quick drying.* And with all these advantages, the unmatched Rice Process makes Barreled Sunlight the most practical paint available today for large-area work.

**Test Barreled Sunlight** against the best paint you've ever used . . . and you'll be sold on it for good. It saves time, paint and labor at the start . . . its longer-lasting whiteness keeps your maintenance budget low. For full details on Barreled Sunlight for industrial use, let us send you a free copy of "More Light with Lasting Cleanliness." Address U. S. Gutta Percha Paint Company, 2-I Dudley St., Providence, R. I.

# BARRELED SUNLIGHT

(WHEN ORDERING, PLEASE SPECIFY "QUICK DRYING FORM")

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"But Why Can't I Go to the Movies?"

"JUST 'cause Pop busted his foot" seems no reason to Johnie why he can't go to the movies. He doesn't realize that a "busted" foot is generally followed by a pretty "busted" pocketbook!

For the compensation you pay an injured worker seldom meets his regular household bills. And when that's the case, the whole family, wife and worker included, become "crybabys" who blame you and your company for the accident and its after effects.

How needless this loss of worker loyalty!... when it's so easy, so *economical* to supply workers with Hy-Test Safety Shoes... when Hy-Tests can prevent toe and foot injuries and save materially on your hospitalization and compensation costs!

Workers like to wear Hy-Tests. That's why they are America's largest-selling safety shoes. But it's up to you executives to find out about them, and learn why it will pay you to have your workers start wearing them. So ACT NOW...Write for booklet, today!

"TURRET-TOP" TOE PROTECTION

Every Hy-Test Safety Shoe has this steel toe cap with the patented anchor flange. It has saved hundreds of toes and thousands of compensation dollars.

HY-TEST SAFETY SHOES

Designed and Manufactured Exclusively by Hy-Test Division, The International Shoe Co., St. Louis, Mo., The Nation's Largest Shoe Manufacturer


3. Retype essential information of original control chart on blank form.
4. Issue control chart to cumulation point.

*Cumulation Point*

A. Supervisor

1. Responsible for proper operation of cumulation point.

B. Checker

1. Check all materials received at cumulation point.
2. Check all assemblies and rejects delivered from assembly lines by accumulators.

C. Specialists, or Stock Men

1. Store all materials in proper section of cumulation point.
2. Responsible for housekeeping in own particular area.
3. Dispense materials to accumulators.
4. Responsible for inventory of component parts.

D. Accumulators

1. Assemble sets of component parts.
2. Report shortages of materials to expediters.
3. Maintain sets of component parts in temporary storage area of cumulation point.
4. Deliver sets of parts to assembly lines.
5. Place parts in position for operators.
6. For each set of parts delivered, obtain corresponding quantity of assemblies or rejects from assembly lines.
7. Deliver assemblies and rejects to checker at cumulation point.
8. Clear assembly lines of excess parts at end of each accumulation, and return parts to cumulation point.

E. Expediters

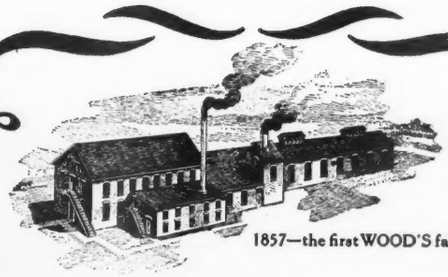
1. Expedite all materials required for next orders.
2. Correct shortages reported by accumulators.

F. Clerk

1. Maintain paperwork.

This division of functions among several individuals is necessary only in large plants where the annual volume of production is considerable. In a small plant, only one or two persons may be needed to operate a cumulation point, but the same functions still exist.

This presentation of fundamental principles, together with concrete guides for their proper application, records an approach to the problem of work-in-process control that has proved effective in actual practice, and it is the authors' belief that similar methods may be applied to many of the industries represented among the readers of FACTORY.



1857—the first WOOD'S factory

# 82 Years Ago

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*of the highest character—*

*PRICES*

*lowest possible*

*consistent with Quality—*

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*courteous, prompt."*

Established 1857

**Wood's** line of power transmission products ranges "From miniature to mammoth."

**Wood's** EVERYTHING IN TRANSMISSION: Bearings—Collars—Clutches—Couplings—Contactors—Hangers—Pillow Blocks—Pulleys—V-Belt Sheaves and Complete Drives.

**TODAY** Our policies remain unchanged and WOOD'S Power Transmission Products still represent the *best buy* in the field—measured both by inherent worth and actual performance. And, because of the knowledge gained by long years of practical experience and the high standards we set more than three score and ten years ago your plant can be operated more economically–your product can be made more profitably.

1939—WOOD'S large, well equipped plant

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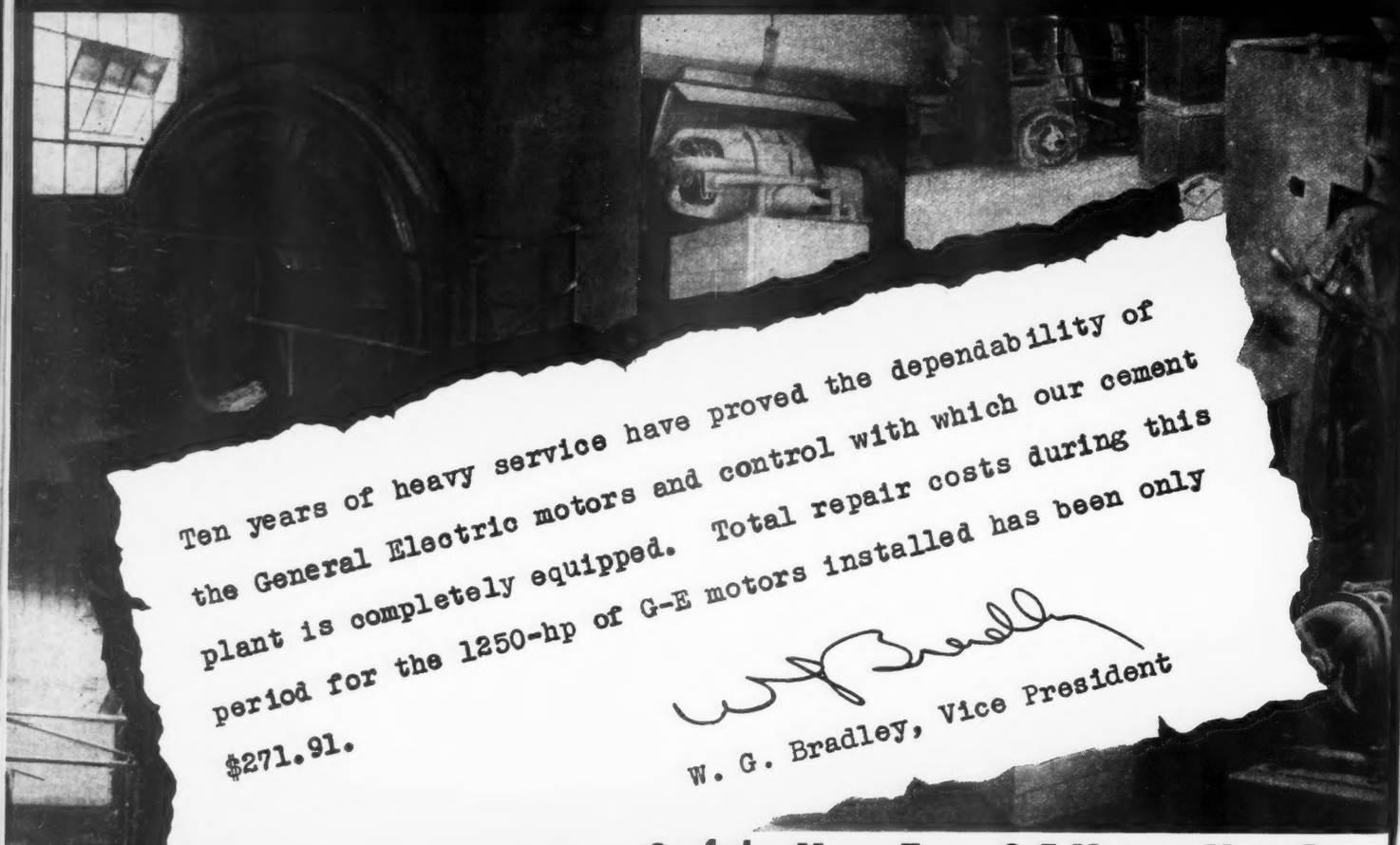
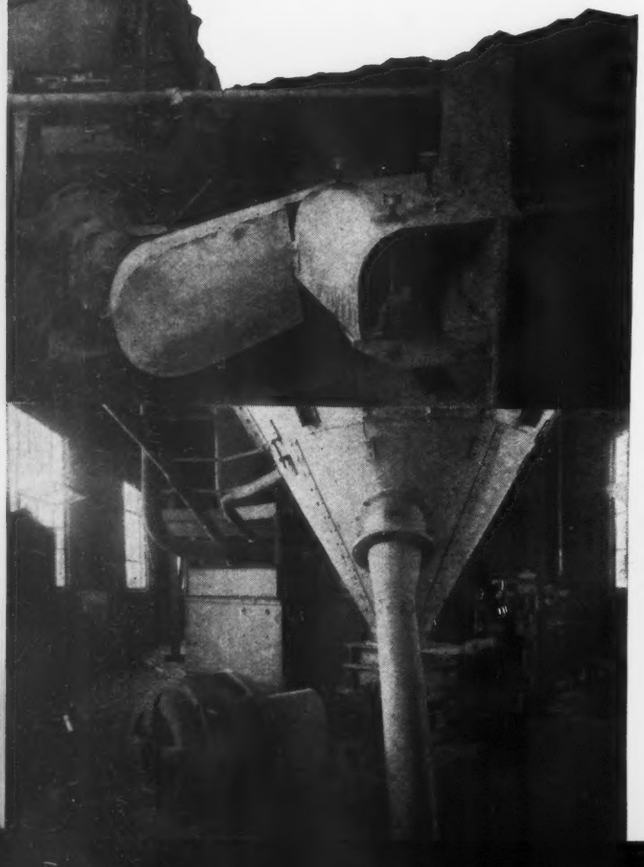


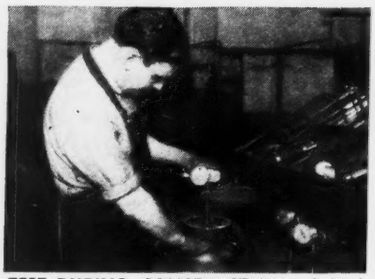
Ten years of heavy service have proved the dependability of the General Electric motors and control with which our cement plant is completely equipped. Total repair costs during this period for the 1250-hp of G-E motors installed has been only $271.91.

W. G. Bradley, Vice President



## 3 of the Many Tests G-E Motors Must Pass

**TESTS ON MATERIALS**—The carbon content of the steel and iron used in G-E motors is carefully tested to make sure that these materials have the necessary strength, toughness, ductility, and endurance



**TEST DURING CONSTRUCTION**—Skilled inspectors, using precision instruments, check motor parts at every step of construction to make sure that they meet the rigid G-E specifications

**TEST ON FINISHED MOTORS**—*Every* G-E motor gets two automatic high-voltage tests to make sure of the high dielectric strength of its insulation

# ¢ per hp for G-E MOTORS at Blue Diamond Cement Company

TOTAL maintenance costs of the 1250 horsepower of G-E motors at the plant of the Blue Diamond Cement Company, in Los Angeles, have been only $271.91 *for the past ten years.* That's only 2.2 cents per horsepower per year!

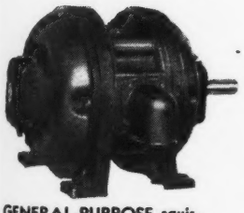
This figure includes both the cost of renewal parts and of labor. No wonder Mr. Bradley says, "Ten years of heavy service has proved the dependability of General Electric motors."

There are good reasons why G-E motors consistently turn in low-cost records like this. New materials and new methods for making better motors are being continually developed in our laboratories. In our plants the latest in machine tools and manufacturing equipment make possible the large-scale production of motors which incorporate these developments.

At every step in their production, G-E motors are rigidly tested. Tests of materials, tests during construction, and tests on *every* finished motor result in motors that pass performance tests like the one at the Blue Diamond plant. For complete information on G-E motors, call the nearest office of the General Electric Company or of the G-E Supply Corporation, or the nearest G-E Motor Dealer. Or write to General Electric, Schenectady, N. Y.

## WHICH MOTOR FOR YOUR JOB?

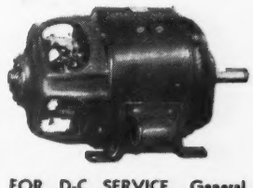
**General Electric makes motors of all types and sizes. Our engineers can help you select motors best suited to your jobs.**



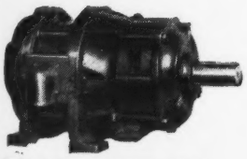
GENERAL-PURPOSE, squirrel-cage induction motor, the simplest kind of motor built, is widely used for polyphase industrial applications

SPLASHPROOF motors give long life and low operating costs on applications where there are splashing liquids or falling particles

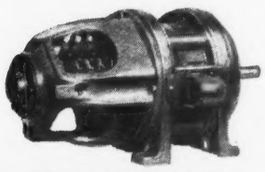
G-E VERTICAL MOTORS are available in either solid- or hollow-shaft construction and in a wide variety of types and mechanical modifications



FOR D-C SERVICE, General Electric manufactures a complete line of d-c motors from ⅓ hp up, in many types and modifications. Use them for fine speed control.

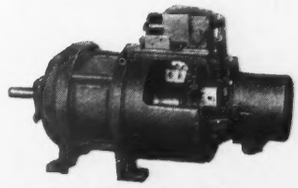


FOR LOW SPEEDS, G-E gear-motors are compact, efficient power units that save valuable space, reduce maintenance, and cut installation costs



FOR ADJUSTABLE-VARYING SPEEDS or for severe starting-duty applications, G-E wound-rotor induction motors provide dependable, economical drives

FRACTIONAL-HP single-phase capacitor motor has high starting torque with low starting current. It is quiet and does not cause radio interference



FOR ADJUSTABLE SPEEDS on a-c power supply, use the G-E Type BTA motor. It is an a-c motor with the desirable characteristics of a d-c shunt motor

GENERAL ELECTRIC

020-295

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CONVEYING AF MACHINERY


## TRADE LITERATURE

**Address Systems**—Catalog No. 139. Public address systems, including intercommunicating and paging systems. Price list.—The Webster Co., 5622 Bloomingdale Ave., Chicago.

**Air Conditioning, Heating**—Condensed Catalog. Air conditioning, refrigeration, and heating equipment. Application, operation, installation, dimensions, and capacities.—Carrier Corp., Syracuse, N. Y.

**Air Eliminators** — Bulletin No. 108. High-pressure air eliminators and automatic bypass for driers, steam mains unit heaters. Description of applications. —Gorton Heating Corp., Cranford, N. J.

**Bearing Units**—Catalog 739. "Sealmaster" sealed, prelubricated, self-aligning normal, standard, and medium heavy-duty pillow blocks; flange units; and take-ups. Dimensions, load capacities, diagrams.—Stephens-Adamson Mfg. Co., Aurora, Ill.

**Castings**—Folder Z880. Stainless steel castings—characteristics and uses in industry.—Atlas Stainless Steel Castings, Irvington, N. J.

**Cleanser**—Folder AN-128. "Annite" Red Label all-purpose cleanser for use in any water. Nature of its action and results it achieves are described. — Quigley Co., Inc., 56 West 45th St., New York.

**Clutches** — Catalog. Standard and Super-Johnson friction clutches. Diagrams of clutches and parts, their specifications and prices.—The Carlyle Johnson Co., Manchester, Conn.

**Combustion Safeguard**—Bulletin 1001-1. Model 1001 "Flame-otrol" which cuts off fuel supply in the event of flame failure. Features and specifications.—Wheelco Instruments Co., 1929 South Halsted St., Chicago.

**Conductivity Bridges, Dip Cells**—Leaflet RC-115. Conductivity bridge for 110 and 125 volts, 50 and 60 cycles, with built-in 1,000-cycle source. — Industrial Instruments, Inc., Bayonne, N. J.

**Cutting Tools** — Wall chart. Instructions for correct grinding of "Kennametal" steel-cutting carbide tools. McKenna Metals Co., 130 Lloyd Ave., Latrobe, Pa.

**Dehumidifier**—Folder. Three models of the "Aqua-Sorber," a dehumidifying unit employing a hygroscopic absorptive material to remove moisture from the air. Methods of operation, applications, specifications. — Aqua-Sorb Co., East Orange, N. J.

**Drive**—Bulletin 307. All-electric adjustable-speed drive for a.c. circuits. Description of units and method of operations.—Reliance Electric & Engineering Co., Ivanhoe Road, Cleveland.

**Fitting**—Bulletin No. 392. "Centring" WeldELL fitting for pipe welding. Method of use; sizes.—Taylor Forge & Pipe Works, P. O. Box 485, Chicago.

**Geared Motor Reducer**—Sales Data Folder 8602. Description, specifications, and prices of straight-in-line Type SME "Ratiomotor."—Boston Gear Works, Inc., North Quincy, Mass.

**Gears** — Leaflet E-1175. Worm-gear drives in industry—their design, manufacture, and advantages. Pictures of drives and applications.—De Laval Steam Turbine Co., Trenton, N. J.

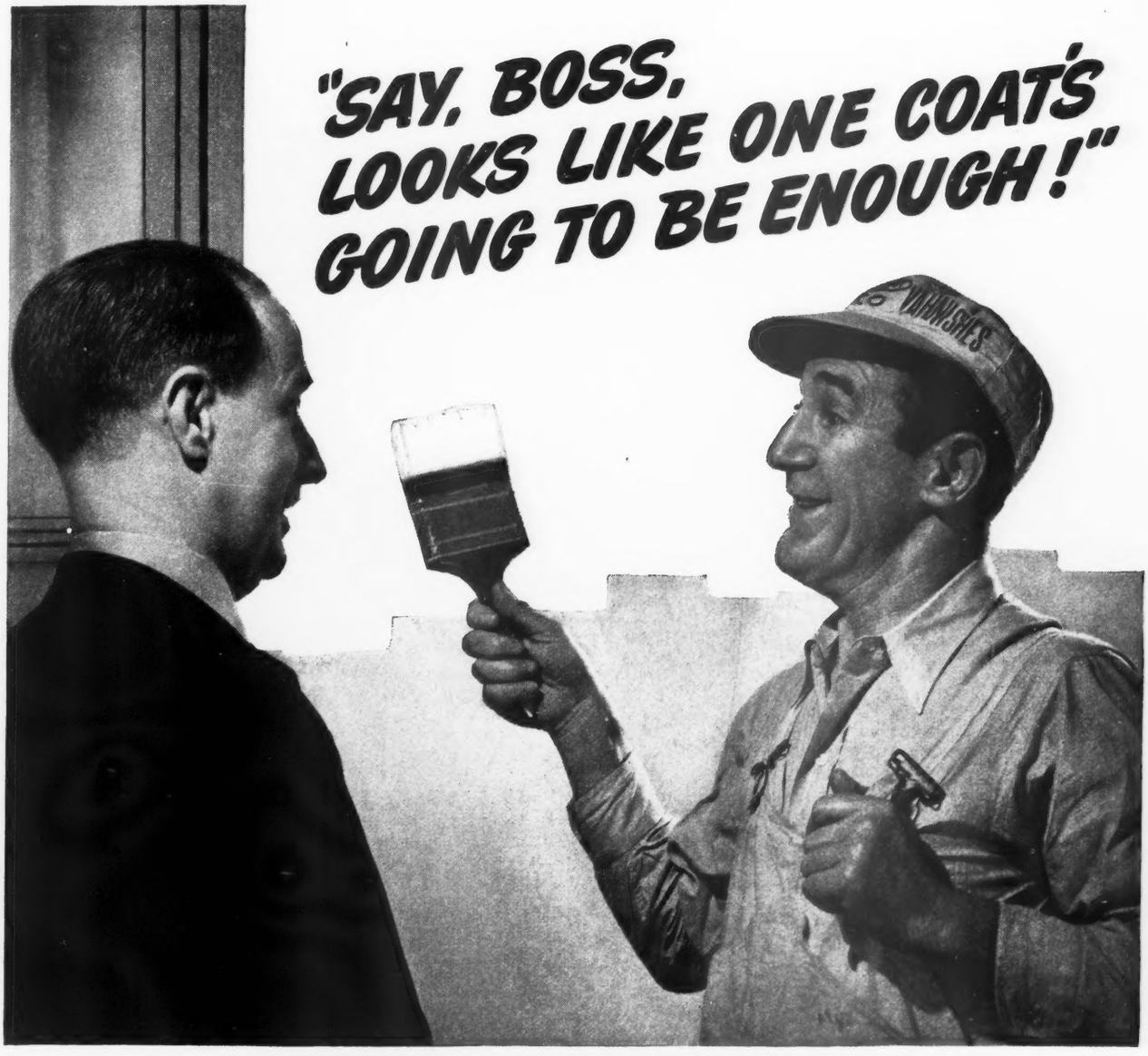
**Hoist**—Catalog H 106. "Hi-Lift" hoist in trolley and rigid suspension types. Features, ratings, applications.—Northern Engineering Works, Detroit.

**Hoists**—Folder. "Speedmaster" hoist features of operation.—Industrial Equipment Division of the Master Electric Co., Dayton, Ohio.

**Immersion Heaters**—Leaflet GEA-3195. "How to Heat Electroplating Baths with G-E Immersion Heaters." Tables, diagrams.—General Electric Co., Schenectady, N. Y.

**Lightning Arresters**—Catalog No. 404. Engineering section with data on characteristics, installation, and performance. Catalog section showing construction and listing characteristics of various types.—Electric Service Supplies Co., 17th and Cambria Sts., Philadelphia.

**Lighting Fixtures**—Catalog 13. Direct




# NEW DULUX

REG. U.S. PAT. OFF.

# HIGH-HIDING MILL WHITE

ALREADY this sensational new Du Pont Mill White is getting a big hand from mill operators.

For even when present paint is in only reasonably good condition, DULUX High-Hiding Mill White gives excellent results with *only one coat!*

This new mill white has all the standout qualities of regular DULUX Mill White—whiter initial whiteness, superior whiteness retention, long run economy. It saves money on overhead because it needs fewer *re*-paintings.

And DULUX High-Hiding Mill White costs less to apply. Its tremendously stepped-up hiding power means only one coat is necessary. If present paint is in very poor shape, a priming coat may be necessary. Fewer coats call for fewer gallons of paint to buy. One coat takes less time to apply than two or three . . . your machinery is idle for a shorter time.

If you would like full information about this amazing new mill white, just write to E. I. du Pont de Nemours & Co., Inc., Finishes Division, Wilmington, Del.

DU PONT

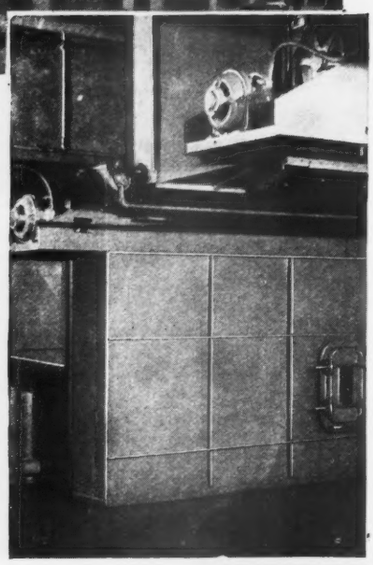
**E. I. DU PONT DE NEMOURS & CO., INC., FINISHES DIVISION, WILMINGTON, DELAWARE**

# "CLARAGE AIR CONDITIONING Helps Us Produce Better La Palina Cigars at Lower Cost"

Camden, N. J. factory of Congress Cigar Co., manufacturer of the famous La Palina.

"We operate nine separate Clarage Systems for conditioning entire Camden plant—all giving very satisfactory service," says Raymond Hanna, Chief Engineer (picture above), who keeps close tab on all mechanical equipment.

Air conditioning installations designed by Percival R. Moses and Sidney R. Klein, 11 Park Place, New York City, consulting engineers.



## THIS CURING ROOM JOB A TYPICAL EXAMPLE!

The Clarage air conditioning system, shown at right, circulates properly temperatured, humidified air throughout this curing room of Congress Cigar Co. (Camden, N. J. plant).

Mr. Raymond Hanna, Chief Engineer, in his unsolicited statement of January 26, 1939 reports as follows: *"Thanks to Clarage we are now able to cure our tobacco better—and faster.* This naturally saves money, but more important still, it helps us greatly in maintaining the high quality of our La Palina Cigars."

JOIN THE THOUSANDS of business executives who *profit continually* from using Clarage air handling and conditioning units and systems!

We manufacture the *right* equipment for practically every job—for conditioning your plant or office, hotel or theatre—mechanical draft apparatus—fans and blowers for various types of industrial needs.

**WANTED**

your next inquiry! Put your problem up to Clarage—more than 25 years' experience. Dial our number in your local 'phone directory, or write us at Kalamazoo.

COMPLETE AIR CONDITIONING • COOLING • VENTILATION • FACTORY HEATING • MECHANICAL DRAFT • FANS and BLOWERS for INDUSTRIAL NEEDS

**CLARAGE FAN COMPANY** KALAMAZOO, MICH.
SALES ENGINEERING OFFICES IN ALL PRINCIPAL CITIES


and indirect types of lighting, combination direct and indirect lighting fixture. Illustrations, specifications.—Chase Brass & Copper Co., Inc., Waterbury, Conn.

**Locomotives** — Bulletin GEA-3071A. Diesel-electric industrial locomotives—23, 35, and 43 tons. Diagrams, tables, illustrations.—General Electric Co., Schenectady, N. Y.

**Lubrication**—Folder. "CW" and "BW" gear-case oil-gage plugs. Styles and dimensions.—Gits Bros. Mfg. Co., 1846-62 Kilbourn Ave., Chicago.

**Materials Handling**—Catalog R-2. Universal work carrier for stacking and moving material. Assembly, applications, parts.—Mechanical Handling Systems, Inc., 4600 Nancy Ave., Detroit.

**Mechanical Power Transmission**—Bulletin 75. Power transmission data on various types of chains, clutches, chain drives, and flexible couplings. — Morse Chain Co., Ithaca, N. Y.

**Motor Control**—Booklet. "Dust the Destroyer" tells what dust does to electrical contacts and describes advantages of vertical contacts. Shows line of motor controls. — Cutler-Hammer, Inc., Milwaukee.

**Motors**—Bulletin B6010. List prices, dimensions, and application of squirrel-cage and d.c. motors; also typical electrical and mechanical variations for special purposes.—Allis-Chalmers Mfg. Co., Milwaukee.

**Motors** — Bulletin GEA-2420. Type KC capacitor motors for constant-speed pump drive. Details of construction.—General Electric Co., Schenectady, N. Y.

**Motors**—Leaflet GEA-137D. Low-speed synchronous motors Type TS with ratings of 20 hp. at 257 r.p.m., and 225 hp. at 450 r.p.m.—General Electric Co., Schenectady, N. Y.

**Motors** — Booklet F-8485. Capacitor motors of 1/20 to ¾ hp. for unit heater, fan, and blower applications. Drawings, dimensions, installations. — Westinghouse Electric & Mfg. Co., East Pittsburgh.

**Motor Starter** — Folder GEA-2964A. Full-voltage magnetic motor starter for machines. Illustrations on construction. Dimensions, ratings.—General Electric Co., Schenectady, N. Y.

**Pipe Tools**—Catalog No. 39-A. Hand tools and portable pipe machines—die stocks, portable pipe-threading machines, portable bolt-threading machines, die and chaser grinder, threading and cutting oil. —The Oster Mfg. Co., 2057 East 61st Place, Cleveland.

**Portable Instruments**—Catalog 123 superseding Catalog 123, Section 1. General and technical data on a. c. and d. c. portable instruments. Includes "Steel-Six" appliance wattmeter for testing household appliances.—Roller-Smith Co., 1766 West Market St., Bethlehem, Pa.

**Priming Equipment**—Leaflet SP-1. Submerged suction priming equipment for De Laval centrifugal pumps. Construction and operation.—De Laval Steam Turbine Co., Trenton, N. J.

**Process Control**—Bulletin 512. Possibilities for cutting production costs and achieving high quality uniformity through use of Bristol's System of Coordinated Process Control.—The Bristol Co., Waterbury, Conn.

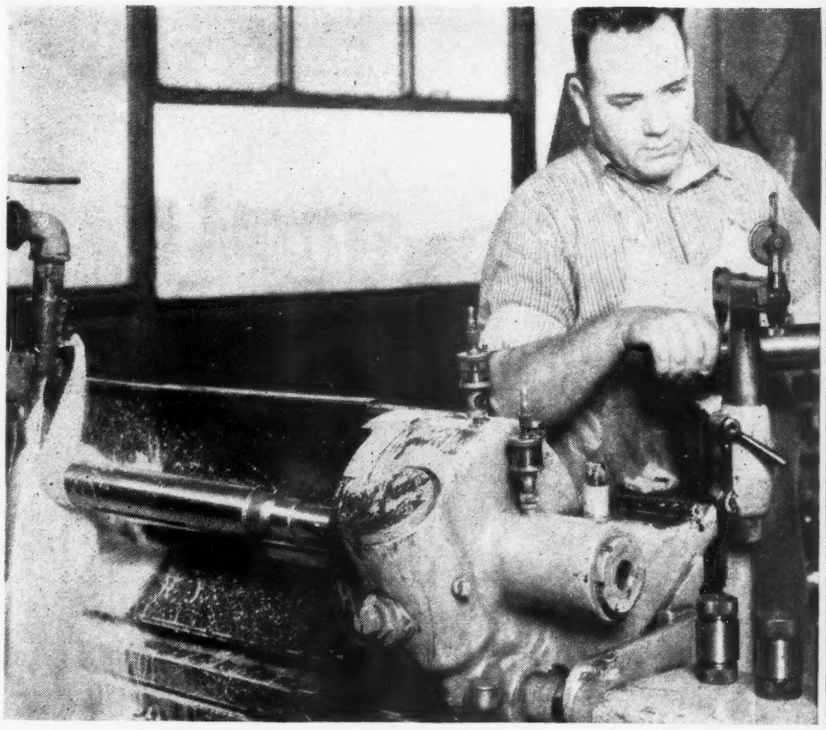
**Pyrometers**—Bulletin 528. Strip-chart pyrometers for temperatures up to 3,000 deg. F. Section from a chart record made by a multiple-record pyrometer is shown.—The Bristol Co., Waterbury, Conn.

**Pyrometers, Thermometers** — Catalog 1101E superseding 1101D. Electric thermometers, pyrometers, photoelectrically balanced recorders, indicators, controllers, recording controllers, potentiometers for thermocouples, described and illustrated. Specifications.—C. J. Tagliabue Mfg. Co., Park & Nostrand Aves., Brooklyn, N. Y.

**Recorder**—Bulletin 339. Specifications, uses, and illustrations of the sensitive milliammeter.—The Esterline-Angus Co., Indianapolis, Ind.

**Refractories**—Book. Boiler-refractory selection and construction. A.S.T.E. standards. Tables and illustrations.—General Refractories Co., Philadelphia.

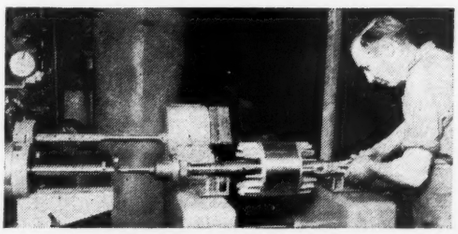
**Relays** — Catalog 12-a. Thermo-magnetic relays for protection of a.c. motors,



# "TAILORING" THE SHAFT for a perfect shaft-bearing fit

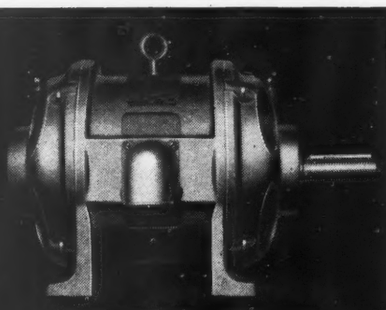
**To assure motor users of long bearing life and consistently easy replacement, exceptional care is exercised in machining shafts for both ball- and sleeve-bearing Delco motors. Shafts of good-grade high-carbon steel are first roughed out in a speedy but accurate manner on a special shaft lathe. Then, on the machine pictured here, all surfaces related to the bearing are ground from centers—a precision operation that holds dimensions across bearing diameters to tenths of a thousandth of an inch. Shafts are submitted to close inspection before assembly with sleeve or ball bearings.**

**Since the fit of shaft and bearing is so essential to long, satisfactory service, Delco feels that the selection of industrial motors should be based on *more* than the electrical and mechanical characteristics required. *Look within* the motor you specify—and include Delco industrial motors in your consideration.**

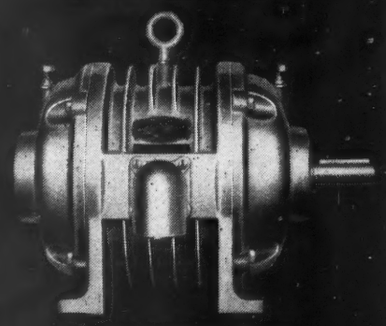


**EVERY DELCO MOTOR IS DYNAMICALLY BALANCED**

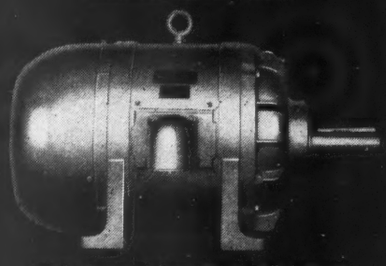
**No motor leaves Delco Products that has not been dynamically balanced on a specially-designed balancing machine. Delco balances every motor. Each end of the rotor and shaft is first balanced independently, while the machine indicates exactly how much compensation is required and where it should be applied. After all adjustments have been made, the complete rotating assembly is given a final check. Delco motors assure satisfactory balance.**



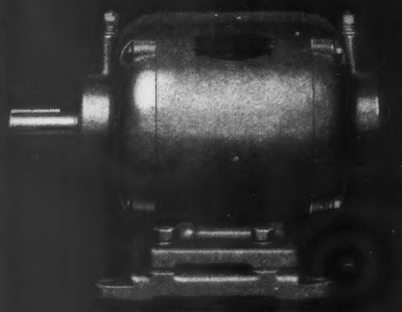
Open Frame, Sleeve or Ball Bearing



Totally Enclosed Ball Bearing



Totally Enclosed Fan-Cooled Ball Bearing



Fractional Horsepower Motor

• • •

Delco industrial AC motors are available in various types, possessing electrical and mechanical characteristics to meet practically every requirement.

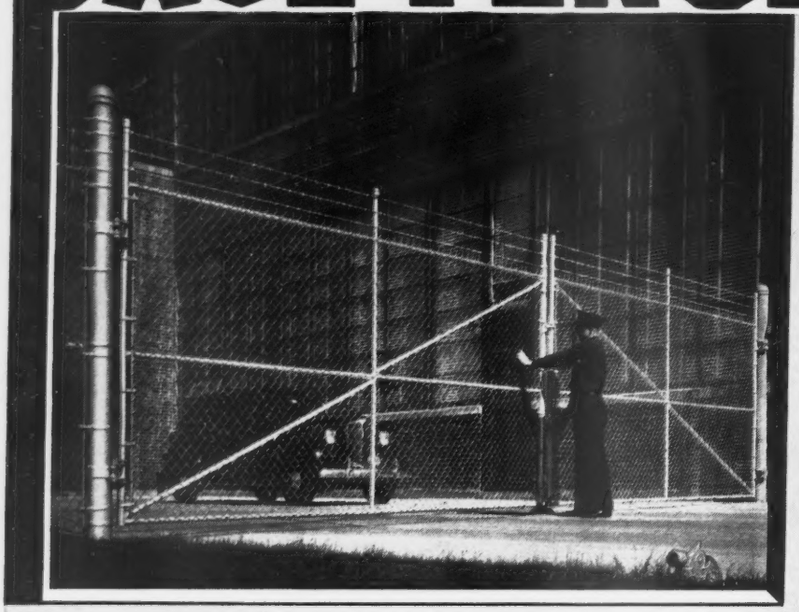
Normal starting torque—normal starting current—high starting torque—low starting current—as well as high slip. Each type available in open frame, sleeve or ball bearing—totally enclosed ball bearing—totally enclosed fan-cooled ball bearing—also multi-speed motors. Electrical and mechanical modifications available. Delco motors comply with NEMA standards.

# DELCO MOTORS

DIVISION OF GENERAL MOTORS CORPORATION

DELCO PRODUCTS DAYTON, OHIO

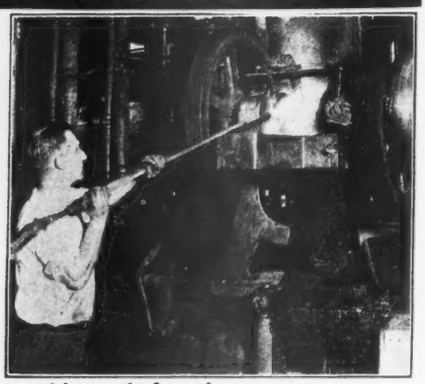
# PAGE FENCE



## HOW HIGH IS AN 8-FOOT FENCE?

Of course an 8-foot fence is 8 feet high, but the point is that PAGE service will help you select the proper fence whether it be 4 or 14 feet high. PAGE—America's first wire fence since 1883—alone offers you a choice of five quality fence metals to fit all atmospheric conditions and an exclusive wing-channel post designed for greater utility. One of our 92 Association Members is nearby to render skilled, courteous service. Secure his name and free literature—write PAGE FENCE ASSOCIATION, Bridgeport, Conn.

# INSURE MAXIMUM MACHINE HOURS



## STOP COSTLY SHUT-DOWNS

*with*

## HYPRESSURE JENNY

Hypressure Jenny Steam Cleaning of machinery before inspection, repair, or use, helps to prevent machine hour losses by uncovering sources of weakness—strain cracks, worn parts, etc. Also saves 25% to 40% of your mechanics' time now wasted in fighting dirt and grease. Additional remarkable savings in cleaning floors, windows, walls, lavatories, trucks, and manufactured products before painting. Find out how much YOU can save. Return the coupon for a free survey.

**HOMESTEAD VALVE MFG. CO., P. O. Box 86, Coraopolis, Pa.**

*Mail* THIS COUPON FOR FREE SURVEY

O. K.! Send that Survey.
Tell us how much JENNY can save us.

We employ.....mechanics on dirty greasy repair work.
We clean.....pieces of machinery monthly.
We clean.....sq. ft. of industrial windows annually.

We want to clean ☐ small tools, ☐ machines, ☐ cranes, ☐ runways, ☐ floors, ☐ walls.

Name .....

Address .....


generators, transformers. — Roller-Smith Co., 1766 West Market St., Bethlehem, Pa.

**Rubber Products**—Catalog. Mechanical rubber products—belting, hose, packing, molded rubber goods, abrasive wheels—and special items are included, plus transmission belt engineering data and technical information on other products. —The Manhattan Rubber Mfg. Div., Passaic, N. J.

**Screws and Bolts**—Pamphlet 639. Recessed-head screws and bolts illustrated to show advantages and applications.—Pheoll Mfg. Co., 5700 Roosevelt Road, Chicago.

**Solder**—Booklet. Common causes of solder failures. Suggestions on how to select most economical solder for various types of jobs.—The Eagle-Picher Lead Co., Cincinnati.

**Solenoids**—Leaflet GEA-2080. A.c. and d.c. solenoids—dimensions and ratings.—General Electric Co., Schenectady, N. Y.

**Starters**—Folder. Type "TT" thermostatic, manual motor starter. Applications, ratings, features of operation and construction.—The Trumbull Electric Mfg. Co., Plainville, Conn.

**Steel**—Bulletin. "Stressproof Steel," No. 2, for shafting and machinery.—Joseph T. Ryerson & Son, Inc., 16th & Rockwell Sts., Chicago.

**Storage Equipment**—Catalog No. 175. Illustrated booklet of line of bins, racks, tote boxes, cabinets, and accessory equipment for toolroom storage.—Lyon Metal Products, Inc., Aurora, Ill.

**Switchgear**—Two Bulletins. B6011: Installation views, wiring diagrams, application and construction data on indoor cubicle-type switchgear, B6012: Vertical-lift metal-clad switchgear—safety features, dimension sheets, and circuit diagrams. — Allis-Chalmers Mfg. Co., Milwaukee.

**Tachometers** — Bulletin No. 720. "Standco" hand tachometers of the governor type. Description of operation and table of ranges available.—Herman H. Sticht & Co., 27 Park Place, New York.

**Temperature Detector**—Folder N33B(2). Uses of "Rayotube" for detecting heat in hard-to-detect places. Can sight on work in motion. Applications illustrated.—Leeds & Northrup Co., 4934 Stenton Ave., Philadelphia.

**Testing Instruments**—Bulletin 21. Portable combustion $CO_2$ indicators and draft gages. Charts on fuel losses in coal- and oil-fired heating plants.—F. W. Dwyer Mfg. Co., 565 West Washington Blvd., Chicago.

**Thermocouples**—Bulletin 235. Kinds of thermocouples, thermocouple assemblies and parts. Installation diagrams, specifications, temperature ranges. Tables with Model numbers and illustrations.—The Foxboro Co., Foxboro, Mass.

**Thermometers**—Bulletin 529. Strip-chart resistance thermometers for temperatures between —40 and +300 deg. F. designed to make 8 temperature records simultaneously on one chart.—The Bristol Co., Waterbury, Conn.

**Tools**—Catalog 39. A 64-page catalog on tools, machines, supplies for fabricating sheet metal. Specifications, prices.—Ward Machinery Co., 564 West Washington Blvd., Chicago.

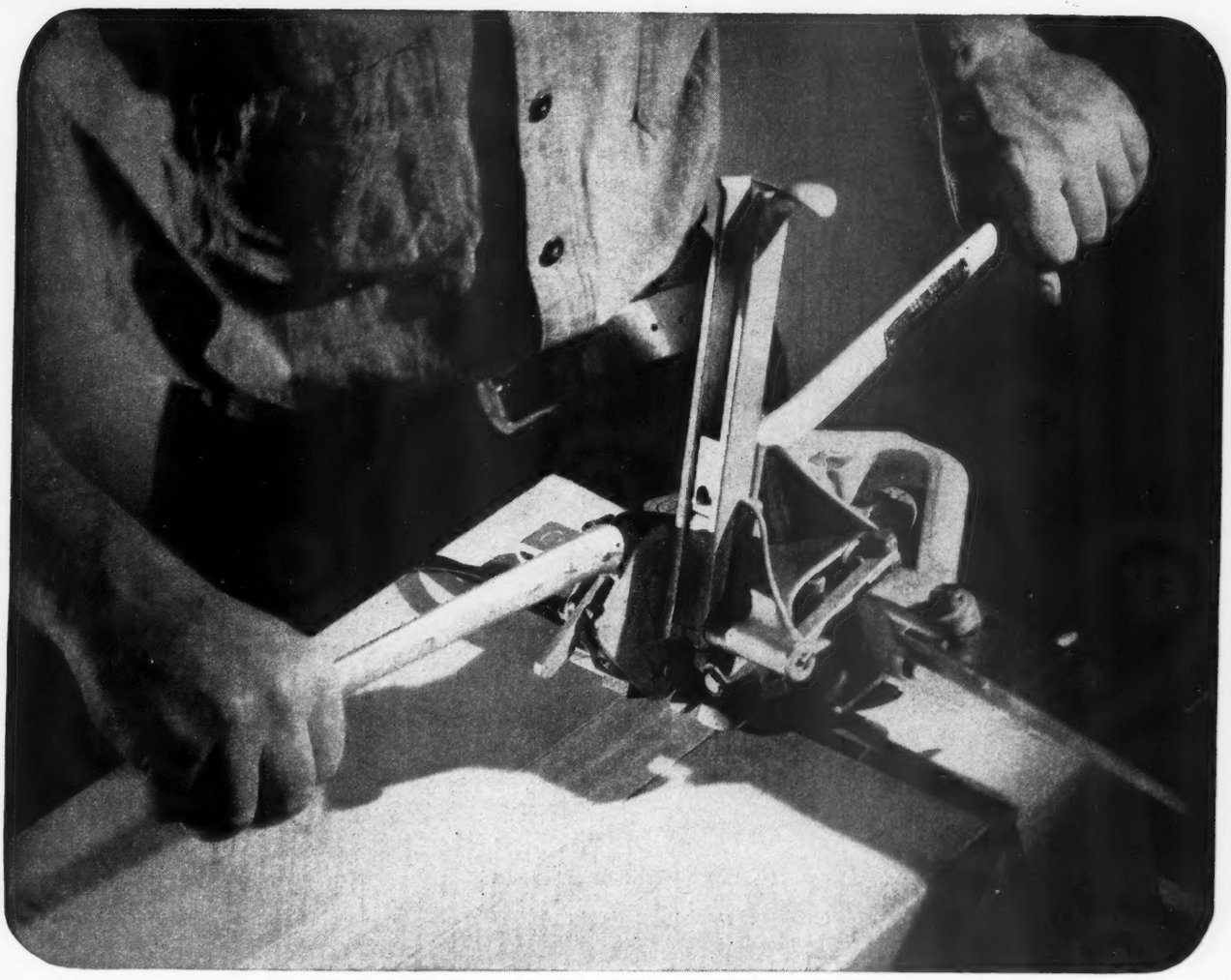
**Transformers** — Bulletin GEA-3085A. "Spirakore" distribution transformers embodying wound-core design described and illustrated. Catalog numbers, prices, and operating data.—General Electric Co., Schenectady, N. Y.

**Unit Heaters**—Folder. Gas-fired unit heaters. Suspended, floor, and duct types. Specifications.—Carrier Corp., Syracuse, N. Y.

**Valves**—Form 183. "Inside Story" of 125-lb. iron valves. Photographic analysis. Reference chart gives types, sizes, and figure numbers for ordering.—Jenkins Bros., 80 White St., New York.

**V-Belts**—Engineering Data Book. For use by machine designers and engineers in designing V-belt drives. Covers standard drives, and sheave factors for special drives.—The Manhattan Rubber Mfg. Division of Raybestos-Manhattan, Inc., Passaic, N. J.

**Ventilator** — Folder. Description and



# 55 YEARS OF EXPERIENCE BEHIND THIS STRAPPING TOOL

**and in these many years of close co-operation with carriers and shippers has come a responsibility to provide equipment for quickly, easily and economically making every shipment "Bound to Get There." The new No. 2 Steelstrapper, the latest addition to the complete line of Acme equipment, is another Acme tool which combines stretching, sealing and cutting operations with an automatic seal feed. ● Acme Steelstrap is sold *only* by Acme sales engineers. They are competent and fully qualified to make practical suggestions for safer, more economical packing of *any* type of product in any kind of wrapping or container. ● By using the Acme Steelstrap system, shipping and packing cost reductions from 10% to 40% have been made by more than 20,000 shippers. A complete estimate of the amount which *you* can save will be furnished on request. Write for complete information, today. There is no obligation.**

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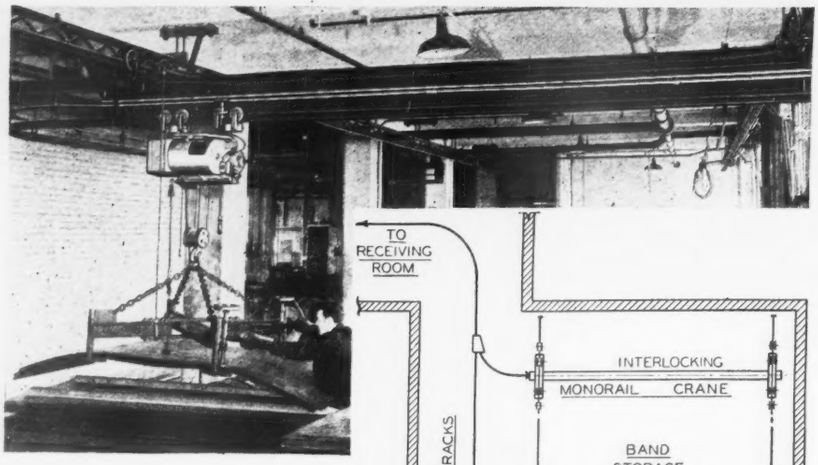
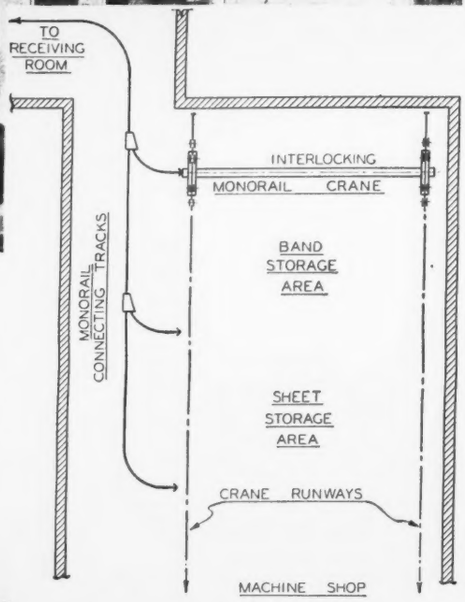
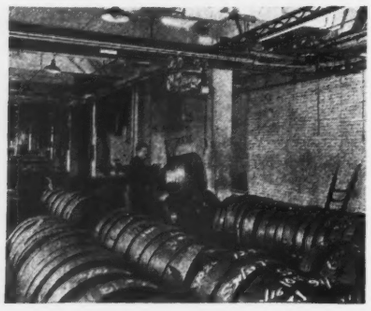
# Low-cost Handling System!

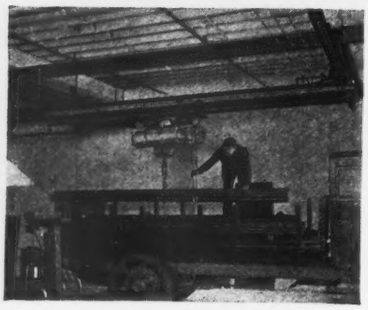





**Steel moves from receiving dock to storage over this simple American MonoRail system at low handling cost.**



*Coordinated system assures one-man control of entire stock.*



*Steel moves safely from truck to stock with no rehandling.*

Since no two overhead handling problems are alike, low-cost solutions are found only in a system that offers extreme flexibility of basic design.

American MonoRail equipment meets varying requirements at low initial cost because standard parts of such flexible design are fabricated into special units and coordinated into systems guaranteed to produce the results intended.

For either manual, electric or automatic operation these systems invariably overcome operating congestion, eliminate costly maintenance and reduce handling expense wherever applied. Engineering consultation is available without obligation.

*A 254 page book used as a technical reference for all data covering Mono-Rail Equipment will be sent on letterhead request.*

**AMERICAN MONORAIL CO.**

**13114 Athens Ave., Cleveland, O.**


details of operation of the "Monovent" continuous-ridge ventilator, mounting and flashing details.—The Burt Mfg. Co., Akron.

**Ventilators**—Folder 56B-2. For mounting on window sill and transom. Available in large and small sizes.—Carrier Corp., Syracuse, N. Y.

**Water Filters**—Bulletin 275-A. Various types and styles of pressure water filters and their applications. Valves, controls, supplementary equipment illustrated. Capacity and dimension tables for single horizontal pressure and single vertical pressure filters.—William B. Scaife & Sons, Oakmont, Pa.

**Wire and Coils**—Catalog C-352 and Handbook. Revision of Catalog 352 on magnet wire—electrical and physical properties—and magnet coils. Handbook contains technical tables for shopmen and engineers.—Anaconda Wire and Cable Co., Advertising Dept., 25 Broadway, New York.

**Wire Rope**—Two Leaflets. Effect of sheave materials on wire rope service. How care and accuracy build quality into wire rope.—Macwhyte Co., Dept. 422, Kenosha, Wis.

**Zinc Die Castings**—Brochure. Data on practice in machining zinc alloy die castings, based on commercial machining procedures in the field. Diagrams and illustrations.—The New Jersey Zinc Sales Co., Inc., 160 Front St., New York.

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## BOOKS

### HEATING AND AIR CONDITIONING

John R. Allen, Late Past President, American Society of Heating and Ventilating Engineers; and James Herbert Walker, Superintendent of Central Heating, The Detroit Edison Company. McGraw-Hill Book Co., Inc., 330 West 42d St., New York. 593 pages, charts, tables, diagrams, index. $4.50.

Fifth edition. Advances in heating and air conditioning practice in the past four years have prompted this fifth edition. Material on controls, air distribution, cooling-coil performance, and cooling-load calculations have been added. A new feature is a chapter devoted to step-by-step calculations and design of an air-conditioning system. As before, this is a comprehensive text covering theory and design on heating and air conditioning for all types of buildings.

### COMPANY PLANS FOR EMPLOYEE PROMOTIONS

Helen Baker, Assistant Director, Industrial Relations Section. Princeton University, Princeton, New Jersey. 48 pages. Selected references. 75c.

Employee promotion, advancement to a new job or salaried position entailing greater skill or responsibility than the one previously held, is presented in relation to personnel advancement below the higher supervisory level. General procedures in promotional programs, training, evaluation, publicity on promotional policies and opportunities, constitute the main topics. Promotional chart of the Libbey-Owens-Ford Glass Company, promotional program in the Kimberly-Clark Corporation, employee promotions in the Western Electric Company, are included.

### INDUSTRIAL MARKET DATA HANDBOOK OF THE UNITED STATES

O. C. Holleran, Chief, Industrial Marketing Unit, Marketing Research Division, Bureau of Foreign and Domestic Commerce. Superintendent of Documents, Washington, D. C. 907 pages. $2.50.

To aid manufacturers in making market studies, in determining size, location, and potential value of markets, this guidebook contains basic industrial market statistics of 1935 on the 3,071 counties of the United States. Collected by the Bureau of Foreign and Domestic Commerce, the Bureau of the Census, the Bureau of Mines, the statistics cover

(*Continued on page* 148)

# NOW 10 YEARS WITHOUT A TURBINE OIL CHANGE

● HERE'S what one paper mill official has to say about his investment in Nonpareil Turbine Oil:

Gentlemen:

"This is to advise you that we have had your Nonpareil Turbine Oil in our Allis Chalmers turbine since its installation in 1929. The original oil is still in the turbine and frequent testing indicates that it has not changed perceptibly throughout almost ten years of use.

"We are very well satisfied with the performance of this oil and congratulate you for being able to design an oil capable of standing this rigid test."

This Wisconsin operator was one of the first to recognize the saving to be made with an oil that is *guaranteed to last the life of his turbine.*

Think of the hundreds of gallons of turbine oil he would have had to buy—the hours of labor in cleaning turbine oil systems he has saved with Nonpareil.

Decide now to find out more about Nonpareil, the only oil guaranteed to *last as long as your turbine.* A Standard Lubrication Engineer can tell you all about it. You can reach him through your local Standard Oil (Indiana) office or by writing 910 S. Michigan Avenue, Chicago, Illinois.

Copr. 1939, Standard Oil Co. (Ind.)

NONPAREIL TURBINE OIL

FIRST IN SERVICE FOR FIFTY YEARS STANDARD OIL (IND.)

STANDARD OIL COMPANY (INDIANA)

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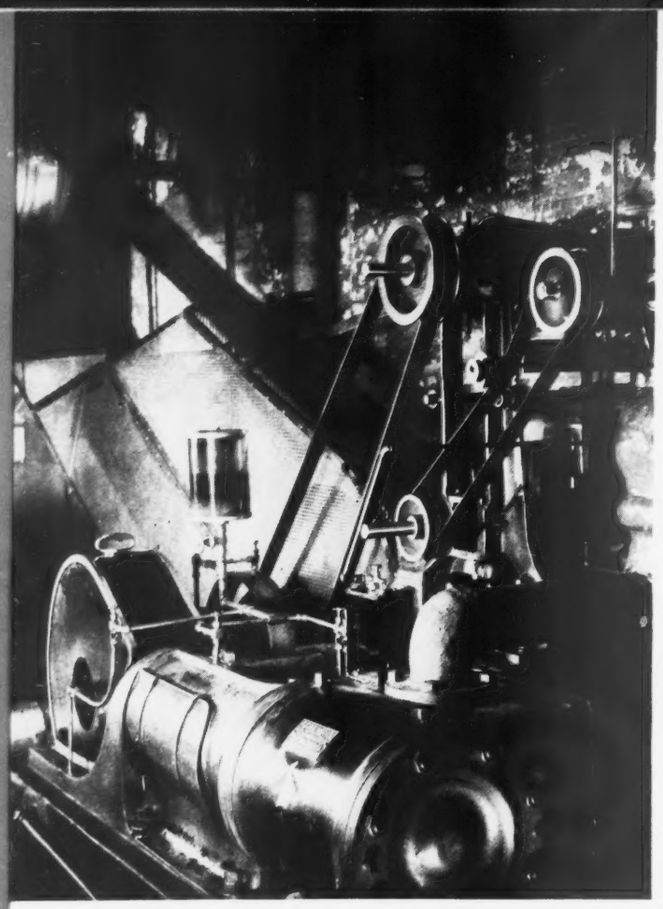
G. . . LUBRICATION ENGINEERING. . . LUBRICATION ENGINEERING. . . LUBRICATION ENGINE



## SAVES 50% OF OIL COST

**STANOCYL**

The saving in maintenance and packing on three paper mill steam engines more than paid for the cost of cylinder oil when these engines were changed over to StanoCyl "W". On top of that there was a 50% saving in cylinder oil costs for the three engines.

Here's what happened. A Standard Lubrication Engineer obtained permission to try to reduce this paper mill's lubricating costs. He started on the 175 HP two cylinder, slide valve engine, similar to the one illustrated here. This engine was belt connected to the paper machine line shaft. It was located some distance from the boiler room, and wet steam was a frequent problem.

A five-weeks test proved that StanoCyl reduced consumption from 3½ gallons per week to 1½ gallons. When StanoCyl was put on the other two engines the same reduction was made. Even with this reduced feed, piston rod packing lasted 40% to 50% longer.

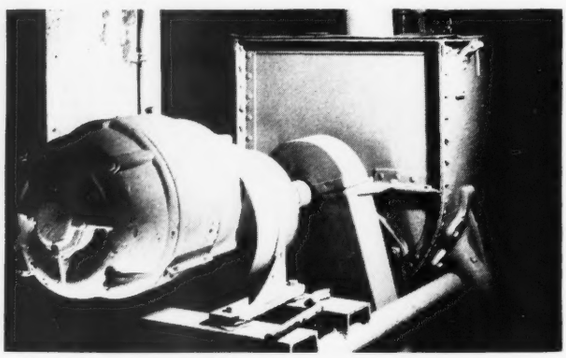
Take this tip for reducing your cost-per-ton in paper making. Your power plant may be the place to start. Let a Standard Lubrication Engineer help you.

## "GREASED OUR MOTOR BEARINGS EVERY 3 DAYS . . . . NOW ONLY ONCE IN 6 MONTHS"

**SUPERLA GREASE**

Dusty plant conditions and severe overloads made motor-bearing maintenance a costly item in a Wisconsin malted milk plant. In spite of frequent greasing the bearings were replaced on one motor every three months. In addition, a number of makes of grease were tried in an effort to eliminate leakage which damaged motor windings.

But that's ancient history now. A Standard Lubrication Engineer tested various grades of Superla Grease in these motors. Superla Grease No. 60 was adopted. That was



over a year ago, and not one motor bearing has failed, nor have any of the motors been rewound because of leakage.

As an extra precaution some of the motor bearings are cleaned and repacked every 6 months. On many installations Superla greased motor bearings have not been touched in over two years.

## MAIL THE COUPON FOR LUBRICATION INFORMATION

STANDARD OIL COMPANY (Indiana) SEPTEMBER
910 S. Michigan Avenue, Chicago, Illinois, Room 1217

Gentlemen: Please send me your Engineering Bulletin on the Lubrication of:

- ☐ Steam Engines
- ☐ Steam Turbines
- ☐ Diesel Engines (Low Speed)
- ☐ Power Transmission
- ☐ Refrigerating Machinery
- ☐ Bearings
- ☐ Compressors and Pneumatic Tools
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*(Available to plant operators in Middle Western U. S.)*

*Name* ..... *Position* .....

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• *Don't confuse* the Engineering Bulletins offered here with ordinary sales literature. These Bulletins discuss the design and operation of each type of equipment and their effect on lubrication. They are available to all plant operating men in the 13 states shown on the map. If you are in this territory, check those you want and mail the coupon.

For more complete information there are Engineers located throughout the same 13 states ready to help you, in any way they can, to lower lubrication or maintenance costs. Get to know the Engineer in your territory. Ask for him at your local Standard Oil (Indiana) office or write 910 S. Michigan Ave., Chicago, Illinois.

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**THE BASSICK COMPANY • Bridgeport, Connecticut**

*Canadian Factory:* Stewart-Warner-Alemite Corporation of Canada, Ltd., Belleville, Ontario

# CAN'T STICK OR CORRODE

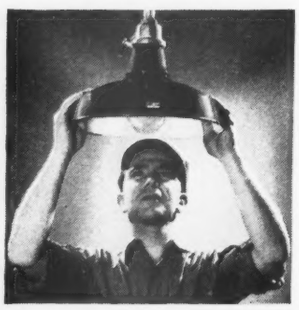
## —A "SNAP" TO REMOVE OR ATTACH

*Nowhere else a fixture like this—the simplest detachable reflector ever made—and the only one which gives you these two important advantages:*

1. *Metal-to-glass connection between hood and reflector; cannot corrode or stick.*
2. *The socket is easily removed without tools; reflector may be immersed for thorough cleaning.*

# GOODRICH DISKONECT REFLECTORS

**To attach, simply lift the plunger; reflector and lamp are removed as a unit. When you press reflector back into the hood, the spring-set plunger snaps solidly into place, locks securely. One hood accommodates both medium and Mogul sockets. Reflectors, finished in permanent porcelain enamel, are offered in a variety of styles. An exclusive Goodrich product.**



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*(Continued from page 144)*

figures on industrial production; employment; value of products; cost of material, fuel, and power; output per wage earner for each of the counties and for every city of more than 10,000 population. Location by counties of 169,000 manufacturing plants, broken down for 280 industries, is given. There are parallel tables on the mining industry with county location tables, by type of mine, for 23,000 mines. Operation summaries show number of firms engaged; material, fuel, and power costs; value of products; number of wage earners for each of the 280 industries mentioned. Information on channels of distribution and on manufacturing operation costs, and a key table on wholesale operation in a number of heavy industries, are included.

### THE SENIORITY PRINCIPLE IN UNION-MANAGEMENT RELATIONS

Frederick H. Harbison, Research Assistant, Industrial Relations Section. Princeton University, Princeton, New Jersey. 39 pages, selected references. 75c.

A digest of experience and opinion on selected aspects of the seniority problem as it applies to union-management relations in the mass production industries, this report attempts to summarize the reasons which lead organized labor to demand seniority rights in trade union agreements; the degree to which, in practice, seniority is modified by other factors such as merit, ability, or competency; and the manner in which seniority rights, as modified, are applied.

### DIMENSIONS AND MATERIALS OF WROUGHT IRON AND WROUGHT STEEL PIPE AND TUBING

A new standard for dimensions and materials of wrought iron and wrought steel pipe and tubing, announced by the American Standards Association, consists of ten weight and thickness schedules running from lightest to heaviest pipe commonly used. Available from American Standards Association and American Society of Mechanical Engineers, 29 West 39th St., New York. 50c.

•

## ON THE CALENDAR

SEPTEMBER

14–17, National Association of Foremen, Sixteenth Annual Convention, Pittsburgh. H. G. Evans, Secretary, 34 Cherry St., Akron.

20–22, National Industrial Advertisers Association, Inc., Annual Conference, New York. Miss Mildred R. Webster, Headquarters Secretary, 100 East Ohio St., Chicago.

OCTOBER

4–13, National Machine Tool Builders Association, 1939 Show, Cleveland. Mrs. Frida F. Selbert, Secretary, 10525 Carnegie Ave., Cleveland.

Schedule of programs of organizations participating in the Machine Tool Congress: October 4th, National Electric Manufacturers Association; 5th, American Society of Mechanical Engineers, Machine Shop Practice Division; American Society of Tool Engineers, Inc.; General Electric Institute; 6th, American Society of Tool Engineers, Inc.; National Association of Foremen; 9th, American Foundrymen's Association, Inc.; Associated Machine Tool Dealers of America; 10th, Cleveland Engineering Society, Machine Design Division; 11th, Society of Automotive Engineers, Inc.; 12th, General Electric Institute.

18–20, Porcelain Enamel Institute, Fourth Annual Forum, Columbus. Frank E. Hodek, Jr., Chairman of the Forum Committee, Porcelain Enamel Institute, 612 North Michigan Ave., Chicago.

22–27, American Welding Society, Annual Meeting, Chicago. M. M. Kelly, Secretary, 33 West 39th St., New York.

23–27, National Electrical Manufacturers Association, Annual Meeting, Chicago. R. J. Blais, Convention Manager, 155 East 44th St., New York.

TWO new star performers join valvedom to serve you —the Nos. 422 and 423 Crane Brass, Solid Wedge, Gate Valves.

We call these valves the "Utility Twins" and that's what they are—ideal for all-around, hard service on 200-pound steam, water, oil, or gas lines. The No. 423 is made with renewable seats and disc of Crane Nickel Alloy—a metal that's matched to the needs of really tough jobs of flow control. The 422 has integral seats and a Nickel Alloy Disc. Both valves, proved in laboratory and field tests, are worthy of any piping system.

There's added utility in the twin-like design of the 422 and 423. Interchangeability of operating parts will show a saving in the need of spares. Advanced features that facilitate dismantling and re-assembly assure widest general usefulness. Both valves have slip-on disc connection.

But most important to you is that the 422 and 423 are Crane-Quality—all the way through. Just like all Crane valves, they are products of sound design . . . expert engineering . . . able craftsmanship—backed by elaborate research and manufacturing experience of over 84 years. To you, Crane-Quality in valves gives strongest assurance of dependable flow control at minimum cost.

### GET COMPLETE INFORMATION IN BULLETIN 311

It will pay you to look into these new Crane valves. Bulletin No. 311 gives you all the interesting facts, sizes, prices. Ask your Crane Representative for a copy or mail the coupon below. Keep this folder handy—with your Crane No. 52 Catalog showing more than 38,000 valves, fittings, and piping items for every need.

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Twenty-one points of superiority fit the Wright Hoists to your purposes. There is zinc coating which prevents corrosion. There is a safety guard for the load chain that makes it impossible for the chain to ride out of the pocket, regardless of position. There are precision load wheel bearings that assure fast, smooth, positive action. Eighteen other important advantages go to make the Wright a safe and economical hoist.

The Wright Catalog gives much useful information on hoists, cranes and trolleys. Write for your copy.

**BUY ACCO QUALITY** *in Wright Hoists, Cranes and Trolleys; TRU-LAY Preformed Wire Rope, Reading-Pratt & Cady Valves; Campbell Abrasive Cutting Machines, American Chains, Page Welding Electrodes and Page Wire Fence.*

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In many instances steel cut-to-shape, by this J & L Warehouse process, saves you money on parts usually made by forging or casting.

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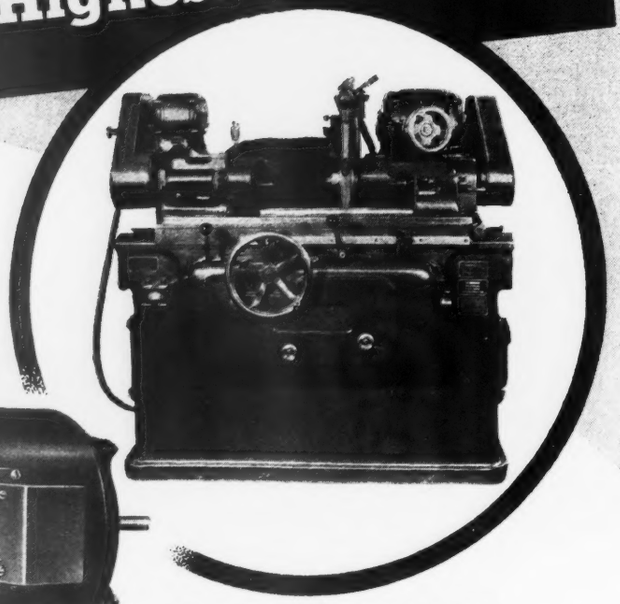
# Because They Get Tough Jobs

# Century Small Size Industrial Motors Are Built to the Highest Standards



Machine tools are tough on motors — sudden loads — on and off operation — running in atmospheres laden with abrasive dusts or oils — all demand that small size motors be built to the highest standards in order to insure low cost, uninterrupted production.

Century Small Size Industrial Motors are built to the same high electrical and mechanical standards usually found only in large integral size industrial power motors. Century gives you all these added advantages, at no extra cost, to meet the greater abuse to which industry subjects these motors.

***Century Motor Specialization***
***+ Correctly Engineered Application***
**= Satisfaction and Economy**

**BALANCE:** Motor vibration frequently registers on the work surface — prevents close tolerances.

Century general purpose stock motors have gained an enviable reputation for being remarkable free from vibration.

**END PLAY SHOCK ABSORBERS:** End "bumping" of armature, caused by irregularity of V-belt or sheave, is absorbed by steel enclosed cork end play washers. Result —more accurate work—quieter operation.

**BEARINGS:** Built with greater safety factor to abnormal belt tension stress—thick walls give sustained accuracy of roundness—shoulder provides large thrust surface, prevents lateral shifting of rotor.

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**INSULATION:** Laminated sheet insulation gives greater protection between winding and core. Varnished cambric for electrical insulation is highly resistant to moisture — fibre board gives mechanical strength.

Saturating the windings with Century special insulating compounds functions two ways — (1) seals surfaces and crevices between turns; prevents magnetic vibration of turns and breakdowns from chafing — (2) resists abrasives, moisture, oil, mild acids and mild alkalies.

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**SELF CLEANING** — Mechanical ventilation — air passages between the frame and field laminations act to carry away heat and at the same time blow dirt through the motor.

Regardless of size, the very highest quality is built into every Century Motor—the result of 36 years of experience in specialized motor building and correct application. Consider the advantages of these Century features, and you'll know why thousands of plants depend upon Century industrial motors for dependable, low-cost, continuous production.

There's a Century Motor Specialist near you who will gladly help you to determine the correct motor application for any particular job. He's there to be of service — call him in.

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Disston Metal Band Saws are made (1) with blades hardened throughout; operate at high peripheral speed; furnished with any tooth spacing desired or (2) with blades hardened on tooth edge only: "Hard-Edge, Flexible-Back Band Saws." Teeth are not punched—they are milled, and then accurately set by machine.
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You make more money by cutting costs, with Disston Bands. They stay sharp . . . for every tooth is alike; edge hardened. All teeth are *milled*, scientifically and accurately set.
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**Standard Engineers . . . specialists in conveyor engineering, with an experience record of over thirty years . . . will assist you in improving your present material handling methods and equipment. There is a Standard office near you—communicate with them.**

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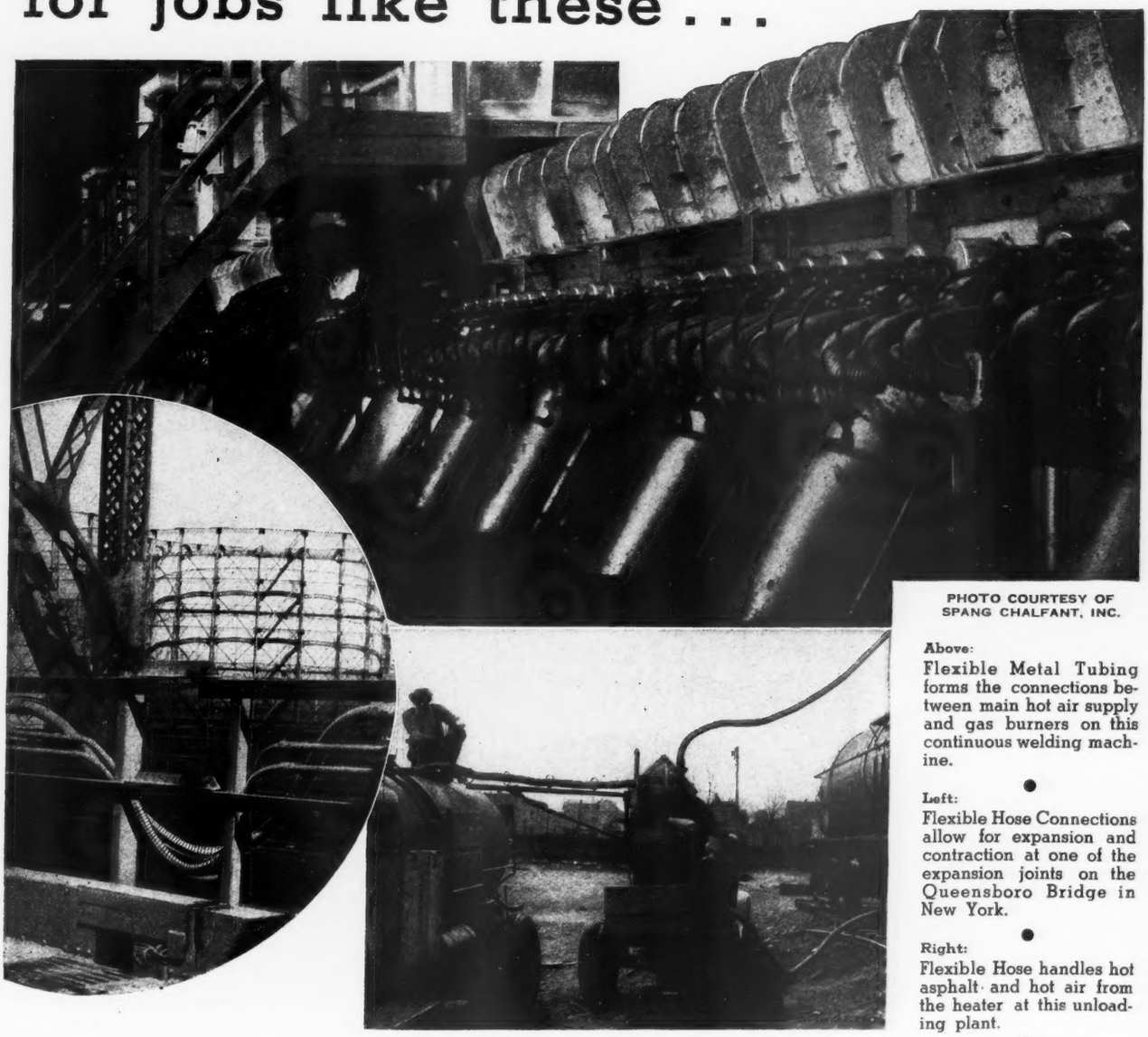

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**Above:**
Flexible Metal Tubing forms the connections between main hot air supply and gas burners on this continuous welding machine.

●

**Left:**
Flexible Hose Connections allow for expansion and contraction at one of the expansion joints on the Queensboro Bridge in New York.

●

**Right:**
Flexible Hose handles hot asphalt and hot air from the heater at this unloading plant.

●

## Flexible METAL Hose and Tubing are your best answer to tough connection problems

For just such problems as those illustrated above, present day designers and engineers find, in Flexible ALL METAL and METAL LINED Hose and Tubing, an ideal combination of the strength . . . safety . . . permanence and dependability of METAL with the true flexibility needed where connections are to be made between moving and vibrating parts . . . or where steam, liquids, gases must be handled under pressure, at high or low temperatures.

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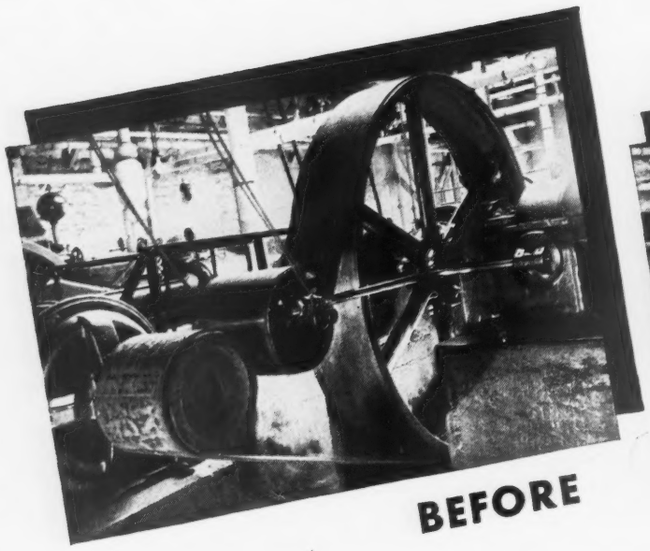
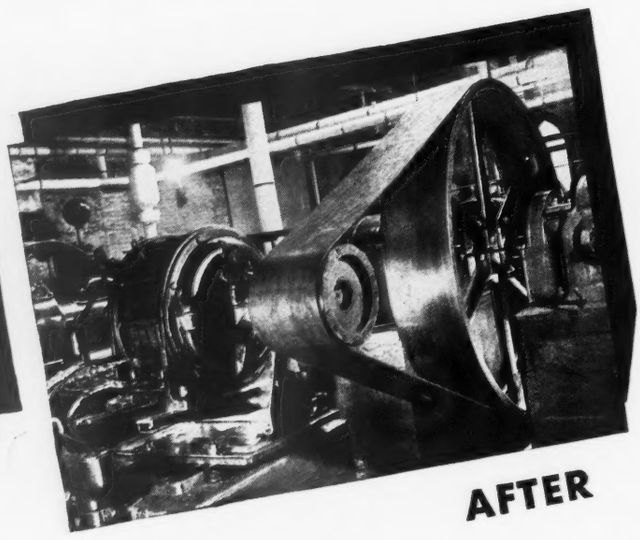


BEFORE



AFTER

# THE STORY OF A LIFE-SAVING JOB ON AN EXPENSIVE BELT

Although the compressor illustrated here was equipped with an expensive Special Tanned Leather Belt, the belt was ruined time and again, long before its normal life expectancy. The constant reverse flexing caused by the gravity idler, was responsible for these frequent replacements.

Recognizing that the fault was in the drive, rather than the belt, the supplier prevailed on the operator to install an "American" Tension-Control Motor Base. From the time the installation was made the belting problem was completely solved.

Furthermore, the saving in maintenance and in power costs have already paid for the motor base. From now on those savings will represent clear operating profit.

You can have an "American" Motor Base on trial . . . and without obligation. Let one prove itself to you.

**LINE UP FOR THESE SAVINGS WITH "AMERICAN" MOTOR BASES**

- Elimination of maintenance attention.
- Doubled normal belt life.
- Increased bearing life.
- Original cost repaid yearly in power savings.

THE AMERICAN PULLEY CO.
4200 WISSAHICKON AVENUE
PHILADELPHIA, PA.

**AMERICAN Tension Control MOTOR BASE**

Photo by Ewing Galloway

Wrong Club, Fellah! You Can't Use Your Midiron to Blast Out of Sand Traps!

# -And You Can't Use The SAME Aluminum Paint for ALL Paint Jobs!

There are 13 PERMITE *Ready-Mixed* Aluminum Paints

**Outdoor • Indoor Equipment • Wet Surface Quick-Drying High Heat-Resisting General Purpose Maintenance Federal Specification Product Finishing — 5 types**

***A Complete Line — a Type for Every Purpose!***

No one-club golfer ever won a major tournament! It's the same with aluminum paints. If it's a quick-drying aluminum paint, you can be sure it won't stick on wet surfaces or protect against high heat. That's why Permite *paint specialists*, working in the only exclusive aluminum paint plant, developed 13 different types of Permite Ready-Mixed Aluminum Paints.

Whatever type of protection you need on whatever type of surface, there is one particular type of Permite Aluminum Paint, custom-built, to best meet those exact requirements.

## *IT'S READY-MIXED*

And because Permite is the successful *Ready-Mixed* Aluminum Paint, no time is lost in wasteful mixing. The specially treated and stabilized Permite pigment, held in suspension by the exclusive Permite synthetic vehicle, does not harden in the can. It does not discolor. Leftovers can be used the next day, next month, next year — with uniform results.

**ALUMINUM INDUSTRIES, INC., Cincinnati, Ohio**
***Distributors in Principal Cities***

***New Permite Paint Manual Tells How, Why and Where***

One of the most complete manuals ever published on why, how and where to use aluminum paints. It is free to buyers of industrial paints. Write for your copy.

# PERMITE READY MIXED ALUMINUM PAINTS

## Give the foreman a break . . . help make his job more efficient by giving him a

# "HALLOWELL"

## STEEL FOREMAN'S DESK

Why expect your foremen to operate from makeshift desks when you can give them sturdy "Hallowell" Steel Desks for so little money. They're strong, rigid and just right height for writing while standing. Convenient pigeon holes and spacious drawers for safe-keeping valuable papers.

Fig. 981 Pat. Pending

## "FULL WELDING" gives far longer life to "HALLOWELL" STEEL STOOLS

Fig. 1334 Pat. app. for

Fig. 1267

Fig. 1249 Pat. app. for

Ordinary riveted stools soon wear loose at the joints so that it's just a matter of time until they're total wrecks. "Hallowell" Stools are different. They have full-welded joints . . . practically one piece construction so they far outlast others. Many styles to choose from. Priced right.

## SMOOTH WORKING SURFACE . . . RIGID CONSTRUCTION . . . EASY TO MOVE

Get all these advantages by equipping with

# "HALLOWELL"

## STEEL WORK-BENCHES

Fig. 732 Pat'd and Pats. Pending Drawer is extra.

No screws, rivets or seams to break the smooth working surface of "Hallowell" Benches. Tops won't split, crack or splinter . . . can't soak-up oil or greases. "Hallowell" Benches are designed so they can be taken apart for removal to new shop locations and there set up strong and firm as ever. How different from the ordinary wooden work-bench that becomes nothing but a pile of kindling when knocked apart! Over 1300 bench combinations available.

## STANDARD PRESSED STEEL CO

BRANCHES: BOSTON, DETROIT, INDIANAPOLIS

JENKINTOWN, PENNA.

Box 546

BRANCHES: CHICAGO, ST. LOUIS, SAN FRANCISCO

Please send me complete information about:

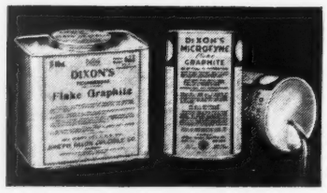
- ☐ "HALLOWELL" FOREMEN'S DESKS
- ☐ "HALLOWELL" STEEL STOOLS
- ☐ "HALLOWELL" STEEL WORK-BENCHES

MR. .....

FIRM .....

ADDRESS .....






## LUBRICATION PROBLEMS SOLVED BY GRAPHITE

Where high temperatures, pressures, and speeds are encountered, Dixon's Natural Flake Graphite stabilizes and lengthens the life of the finest industrial lubricants. Also superior as a dry lubricant and for coating gaskets and packing, and for many other important uses. Chemically inert and insoluble in all acids, alkalies, oils, etc.

DIXON'S TICONDEROGA FLAKE LUBRICATING GRAPHITE comes in cans, barrels, and drums—in large Flake Size No. 1, and powdered Flake Size No. 2. DIXON'S MICROFYNE FLAKE LUBRICATING GRAPHITE is processed to microscopically subdivided particle size for inclusion in oils, greases and applications to mechanisms having limited tolerances between frictional surfaces. Full information from your dealer—or write Dept. C-44.

JOSEPH DIXON CRUCIBLE CO.
JERSEY CITY NEW JERSEY

DIXON'S GRAPHITE PRODUCTIONS

SEND FOR CIRCULARS

*A Quality*

## LEATHER BELT

The first step toward economical plant operation. Satisfactory performance guaranteed. See your supply dealer today or write for illustrated catalogue containing valuable horse power tables.

## ALEXANDER BROTHERS

PHILADELPHIA, PENNA.

BRANCHES:
NEW YORK · CHICAGO · CHARLOTTE · DALLAS

## "Just because it's so roomy, now you won't live with us any more!"

There is plenty of room in Allen-Bradley solenoid starters. The generous wiring space eliminates cramped wiring and skinned knuckles. The white interiors, many knockouts, and easy-to-get-at terminals make wiring simple and easy.

Also, Allen-Bradley starters have no bearings, pins, or pivots to stick, and no flexible shunts to break. The silver alloy contacts require no cleaning or filing. That's why they last so long.

Save time . . . reduce installation expense . . . insure continuous production by using Allen-Bradley solenoid starters throughout your plant.

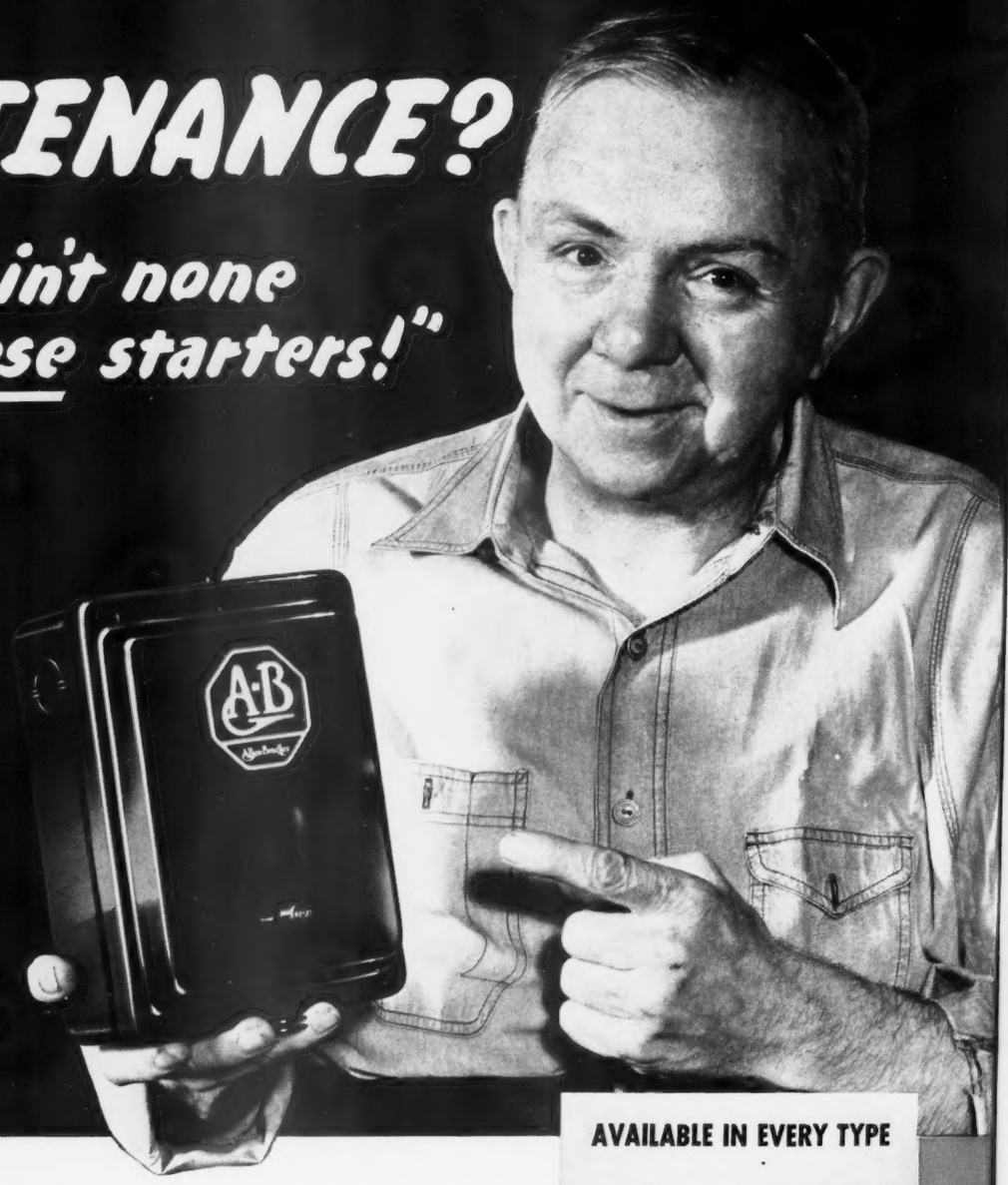
Bulletin 709 Solenoid Starter. Note the ample space in the cabinet for wiring.

# ALLEN-BRADLEY
## SOLENOID MOTOR CONTROL

QUALITY

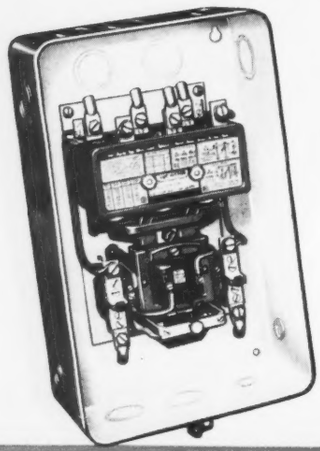
# "MAINTENANCE?

## - there ain't none with these starters!"




"From the day you put in Allen-Bradley starters (and installing 'em is easy as A-B-C) you can forget about control troubles. You can say good-bye to contact cleaning. You never have to touch the silver alloy contacts. In fact, there ain't no maintenance of any kind when you put in these Allen-Bradley solenoid motor starters. There is lots of difference between them and other starters."

## Five reasons why Allen-Bradley Solenoid Starters give less trouble



**NO CONTACT MAINTENANCE**
The double break, cadmium silver alloy contacts never need filing. They are always in perfect operating condition.

**SIMPLE CONSTRUCTION**
No bearings, no pivots, no flexible jumpers, no complicated mechanisms. Such simplicity insures freedom from trouble.

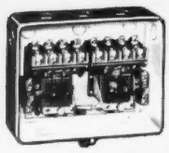
**GREATER SWITCHING CAPACITY**
These solenoid starters will easily interrupt currents of not less than ten times their maximum horsepower rating.

**NO UNNECESSARY SHUTDOWNS**
Allen-Bradley solenoid starters do not open and interrupt production when line voltage conditions are momentarily bad.

**LONG CONTACT LIFE**
Because valuable contact material is not filed away, the contacts last many times as long as ordinary contacts.

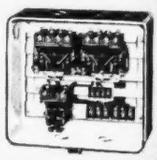
### AVAILABLE IN EVERY TYPE

**COMBINATION**
Bulletin 712 A-C Combination Starting Switch with hand disconnect switch.



**REVERSING**
Bulletin 705 A-C Reversing Switch for starting and reversing motors.

**MULTI-SPEED**
Bulletin 715 Multi-Speed Starter for two-speed, squirrel-cage induction motors.



**MAIL COUPON FOR BOOKLET**

Allen-Bradley Company
1321 S. First Street, Milwaukee, Wis.
Please send me a copy of "The Story of the Solenoid Starter."

Name_____

Company_____

Address_____

**ALLEN-BRADLEY**
**SOLENOID MOTOR CONTROL**
QUALITY

# Resists Washing Effect of HOT WATER AND STEAM

Battery of steam-heated multiple platen hydraulic presses in Laurel, Mississippi plant of the Masonite Corporation. This equipment is Texaco Lubricated 100%.

Wire rope and exposed heavy-duty gearing are protected against wear, rust, corrosion, water and weather when lubricated with Texaco Crater Compound.

IN PRODUCING MORE than a million square feet a day of Structural Insulation and Presdwoods, the Masonite Corporation operates steam-heated multiple platen hydraulic presses.

As the pistons of these presses come up, the lubricant on the piston surface is subjected to the washing effect of the effluent . . . creating a lubrication problem of importance.

Searching the market for a solution, Masonite tried Texaco Crater Compound.

That was 6 years ago, and ever since, these presses have had no other but Texaco Lubricants.

Texaco Crater Compound is adhesive, clinging to metal despite the heat and the washing action of the hot aqueous effluent. Experienced lubrication engineers, trained in the selection and application of Texaco Crater Compound will be glad to demonstrate that savings can be made with Texaco Perfected Lubrication.

For prompt engineering service and deliveries phone the nearest of our 2279 warehouses in the U. S., or write to:

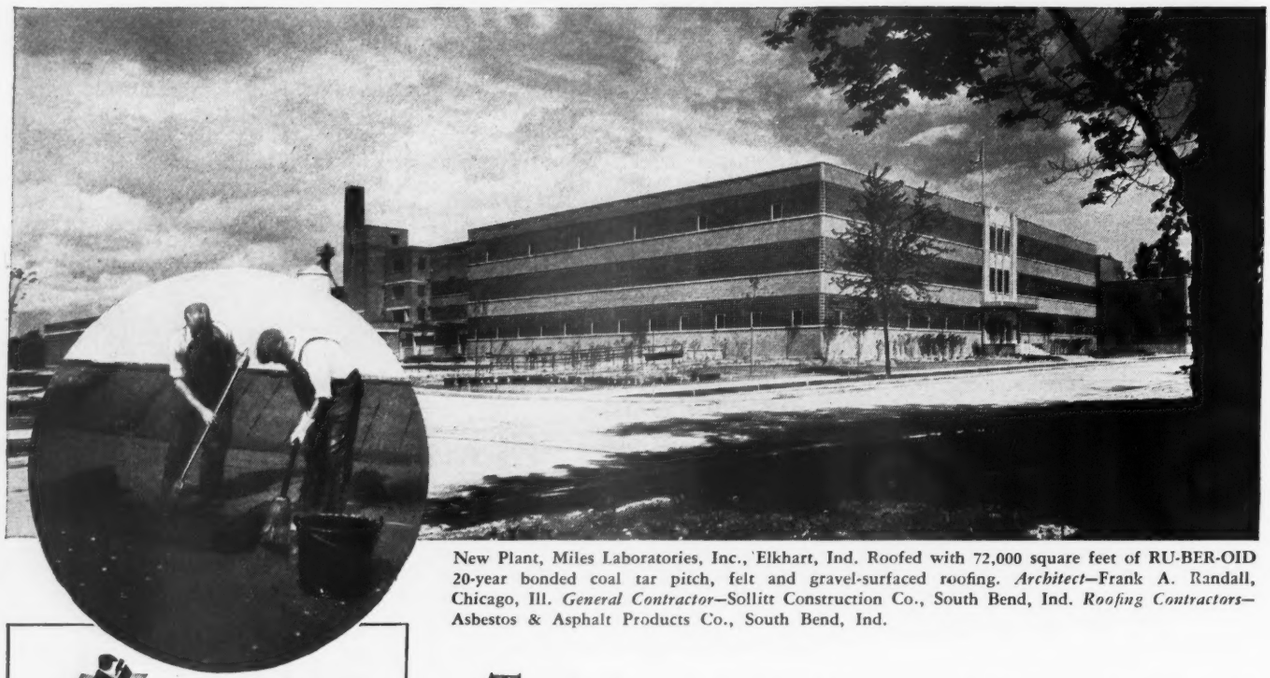
The Texas Company, 135 East 42nd St., New York City, N. Y.

Texaco Dealers invite you to tune in The Texaco Star Theatre—a full hour of all-star entertainment—Every Wednesday Night—Beginning Wednesday, September 13—Columbia Network—9 E.D.T., 8 E.S.T., 8 C.D.T., 7 C.S.T., 6 M.S.T., 5 P.S.T.

# TEXACO Crater Compound

*In more ways than one, you can*

# MAKE THE ROOF FIT YOUR PLANT



New Plant, Miles Laboratories, Inc., Elkhart, Ind. Roofed with 72,000 square feet of RU-BER-OID 20-year bonded coal tar pitch, felt and gravel-surfaced roofing. *Architect*—Frank A. Randall, Chicago, Ill. *General Contractor*—Sollitt Construction Co., South Bend, Ind. *Roofing Contractors*—Asbestos & Asphalt Products Co., South Bend, Ind.

## WRITE

**for full facts about**

## RU-BER-OID INDUSTRIAL PRODUCTS

The RUBEROID Co.
500 Fifth Avenue, New York, N.Y.

We are checking those that particularly interest us.

- ☐ RU-BER-OID Built-up Roofs
- ☐ RU-BER-OID Rigid Roof Insulation
- ☐ 4.2 Corrugated Asbestos-Cement Sheets
- ☐ 85% Magnesia Pipe Covering
- ☐ Genuine RU-BER-OID Roll Roofing with Patented 7-layer Seams
- ☐ High Temperature and Asbestos Pipe Coverings

FM-9

*Name of Company*_____

*Name of Individual*_____

*City*_____ *State*_____

The roofs of your plant should be *custom-built.* Custom-built to local climate—to atmospheric conditions—to alkali or acid fumes—to special fire hazards. Custom-built to fit the design and probable life of the building itself.

An example of a RU-BER-OID Built-up Roof is pictured above. This roof is custom-built to meet all the conditions imposed. It is bonded for 20 years.

Every RU-BER-OID Built-up Roof is, in fact, a custom job, based on local conditions. Here's the reason. Ruberoid manufactures *all three major types* of Built-up Roofs—asphalt, asbestos, and coal tar pitch and felt—in more than 30 specifications. And behind every RU-BER-OID Built-up Roof is a company with more than half a century's worldwide specialized roofing experience.

Each year, more executives in charge of factory maintenance ask The Ruberoid Co. to work with them on their roofing problems. These executives recognize the great value of being able to select the exact roof required, and then to choose an *approved* roofing contractor. They know that they can have both the roofing and the workmanship bonded for 10, 15 or 20 years, according to the specification selected.

If you have a roofing or a re-roofing problem, we urge you to write and have a Ruberoid representative call. Or if you wish specifications for filing, simply mail the coupon, checking those industrial products that most interest you. Write, or mail the coupon today.

# RU-BER-OID BUILT-UP ROOFS

**THE RUBEROID CO., EXECUTIVE OFFICES: 500 FIFTH AVENUE, NEW YORK**

## He can't run a factory

These modern microbe-men probably wouldn't know a drill press from a turret lathe. But they certainly do know how to analyze and compare products in a laboratory. They say that for removing grease, grime and dirt—and infection-inviting bacteria, you can't improve on formula SBS-11. It replaces ordinary soap, costs less than 1¢ a week per employee. Used today in 2813 plants. Write now for generous free trial supply for your plant employees, both male and female.

**FORMULA SBS-11**

The WASHWORD of Industry

SUGAR BEET PRODUCTS CO., 300 Waller St., SAGINAW, MICH.

**MAGNOLIA METALS**

**MAGNOLIA ANTI-FRICTION METAL**

*300% Better than Genuine Babbitt . . . . at ½ Cost!*

Magnolia Anti-Friction Metal has the lowest coefficient of any known bearing metal. Unequalled for steady high speed and heavy pressures.

For Corliss Engines, Gas Engines, Compressors, Motors above 10 H.P. and all transmissions. Keeps shafts in good condition—lowers your operating costs.

***Full details and literature upon request.***

**MAGNOLIA METAL COMPANY**
120 BAYWAY, ELIZABETH, N. J.
SAN FRANCISCO FORT WORTH MONTREAL

✓ PENETRATION
✓ PORE-SEAL
✓ COLOR
✓ CLEANLINESS
✓ DUSTLESSNESS
✓ WEAR-RESISTANCE
PLUS *Safety*

**PIGMENTED FILPOR**

**A PREFERRED FINISH FOR CONCRETE FLOORS**

PIGMENTED FILPOR, a penetrating liquid preservative, produces a *non-slippery finish* in which safety engineers have a particular interest. It is not a *paint* but a combination of vegetable oils, gums and solvents to which color pigments are added. It enters the pores of the floor and binds the surface particles of the concrete to help eliminate dust hazards and forms a hard elastic film which is extremely resistant to wear and traffic.

Porous floors cake up with grease and oily dirt and are difficult to clean. By finishing the floor with PIGMENTED FILPOR, the pores are tightly sealed and lower maintenance costs will result.

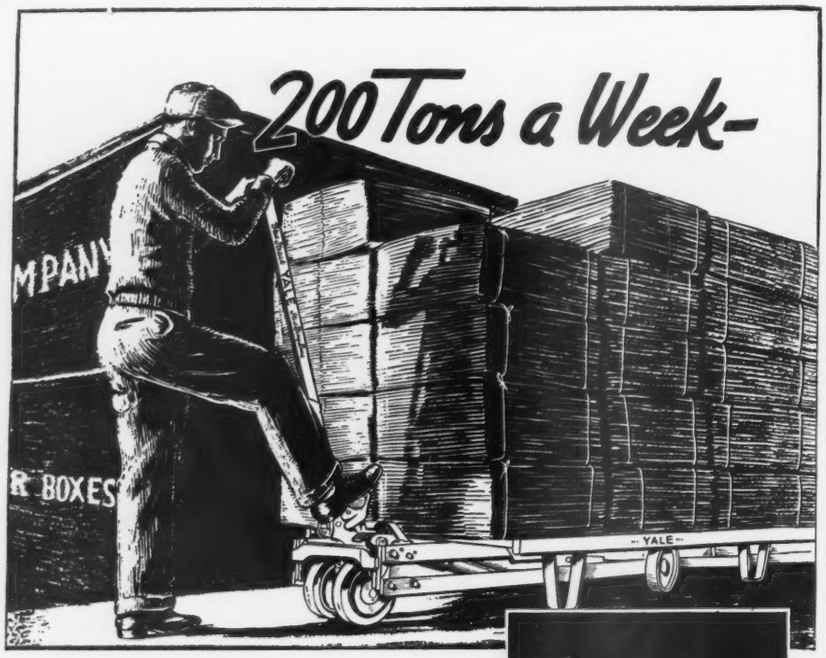
**● CLEAR FILPOR FOR WOODEN FLOORS**

To seal the pores of wooden floors and to enhance the natural beauty of the wood grain, CLEAR FILPOR is suggested. It is highly resistant to wear and tear and will seal up the pores of the wood and help prevent oil, dirt and grease from damaging the floor itself.

APPROVED BY MAPLE FLOORING MANUFACTURER'S ASS'N.

*Send for our free 36 page booklet entitled, "The Proper Maintenance of Floors."*

**WEST DISINFECTING CO.**
Dept. J, 42-16 West Street
Long Island City, New York




## HANDLED BY YALE LIFT TRUCKS

200 tons of corrugated boxes a week —a lot of paper for *any* trucks. But that's the job that YALE Lift Trucks perform for the Great Southern Box Company every week in the year. And perform perfectly!

Following are some excerpts from a letter written by Mr. A. O'Shaughnessy, Vice-President of the Great Southern Box Company:

> "The YALE system of hand lift trucks and skid platforms is the most efficient system of handling our product that we know of. We could not do without it. Maintenance cost is remarkably low — practically nothing. The Blue Streak is the easiest and fastest truck to operate that we have ever used. It is impossible to get a 'flying handle', and we have never had an accident of any kind. ***You cannot improve on YALE service.***"

"You Cannot Improve on Yale Service"—the keynote of YALE success!

Every truck that leaves our plant is the best of its kind. The safest—the most economical—the most efficient. Profit by the experience of industrial executives like Mr. O'Shaughnessy. BUY YALE!

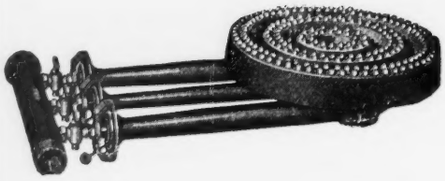
Look in the phone book for your nearest YALE representative.

THE FAMOUS YALE BLUE STREAK— Single Stroke Hand Lift Trucks, 2,500 Lbs. Capacity.
NARROW FRAME MODEL
WIDE FRAME MODEL
YALE MARKED IS YALE MADE

YALE

THE YALE & TOWNE MFG. CO.
PHILADELPHIA DIVISION, PHILADELPHIA, PA., U. S. A.
IN CANADA: ST. CATHARINES, ONT.

## Faster, Better Work at Less Expense with . . . Johnson's 60 BCE



### *Triple Atmospheric Burner*

The Johnson Burner assures perfect combustion, greater efficiency and more intense heat at lower cost with the Patented Johnson Venturi Air Mixer and Johnson direct jet regulators. It's the ideal burner for all open flame work, giving maximum flexibility with all three burners operating independently . . . singly, in pairs or in triple. Heavy, sturdy construction gives you longer life and less operating cost. Write today for your FREE catalogue.

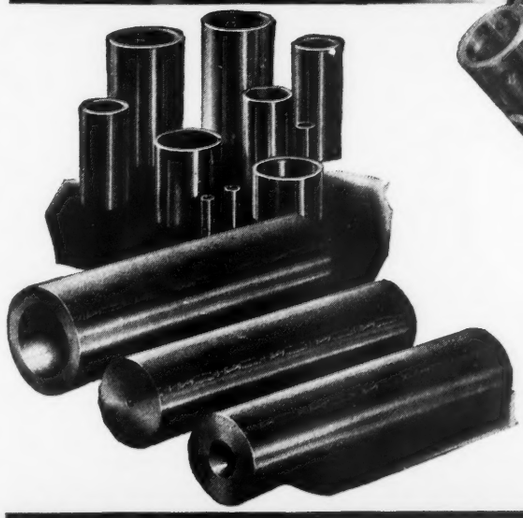
JOHNSON GAS APPLIANCE CO.
Cedar Rapids IOWA

NITROSE
the "one coat" protective covering for metal surfaces.
STOPS CORROSION
from water, acid fumes, alkalies, and extreme temperatures.
AT LESS COST
Saves up to 2/3 of usual preparatory and application costs — gives longer and more complete protection.
NITROSE
WRITE

MADE ONLY BY
THE NITROSE COMPANY, INC.
PEORIA, ILL., U. S. A.

# THESE *Better Bearings* CONSERVE INDUSTRY'S POWER

FOR PROFITS
MACHINE
TOOL SHOW
CLEVELAND
OCT. 4 to 13, 1939



● More power gets to the job when the electric motor turns on Bunting Bearings because of inherent exclusive anti-friction properties in the bearing metal. Made to the motor manufacturer's original designs. Available from stock for all makes of motors from 1/50 HP to 100 HP. Write for catalog.

Bunting's Standardized Bronze Bearings for all mechanical applications and Bunting Precision Machined Bronze Bars afford low cost high quality bearings for all equipment and maintenance needs. Leading wholesalers have stocks . . . 52-page catalog on request.

The Bunting Brass & Bronze Company, Toledo, Ohio.
Warehouses in All Principal Cities.

# BUNTING

BRONZE BUSHINGS
PRECISION BRONZE BARS

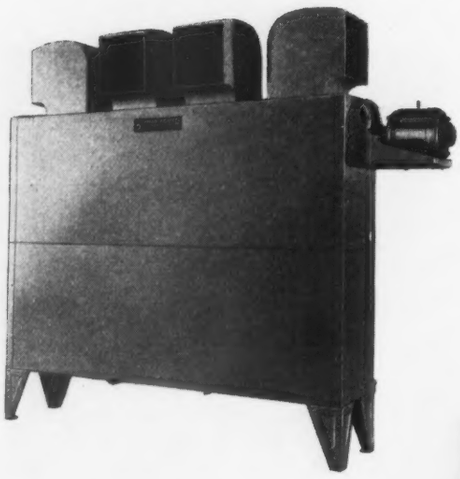
BEARINGS
BABBITT METALS

# LOWER COST UNIFORM HEAT All Winter Long!

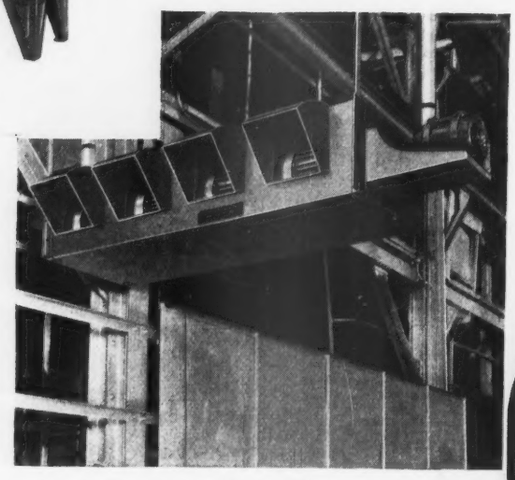
What is more irritating than working areas that are always either too hot or too cold?

If you have one of those old fashioned heating systems that gives you costly, inefficient service, we suggest that you look into the advantages and economies of Buffalo Unit Heaters right now.

Sizes and types for every heating requirement. Write today for literature.



Buffalo Floor Type Unit Heater showing 90 degree Elbow Outlets arranged for distribution of heat in three directions.



Buffalo Suspended Lowboy with 45 degree Outlets set for wide even distribution of the warm air.

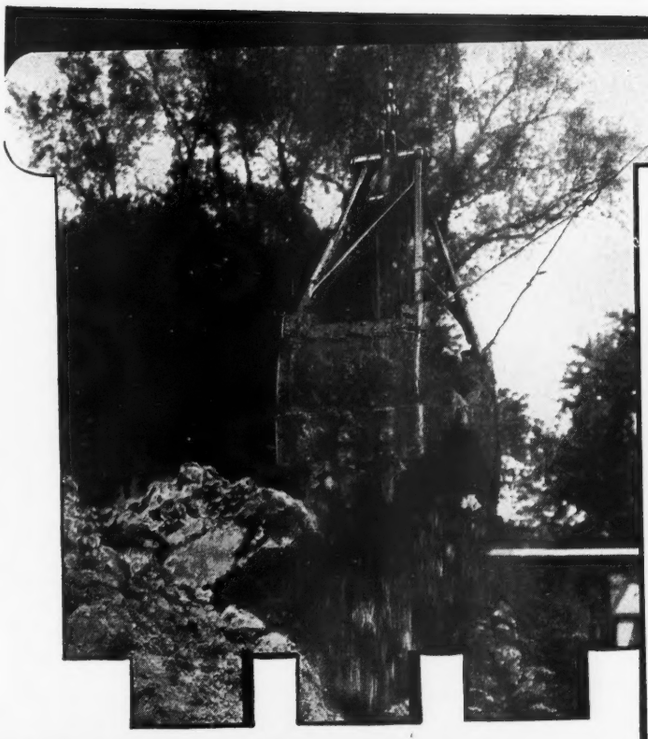
**BUFFALO FORGE COMPANY**

**471 Broadway, Buffalo, N. Y.**

Branch Engineering Offices in Principal Cities; Canadian Blower & Forge Co. Ltd., Kitchener, Ont.

Buffalo Breezo-Fin Unit Heater, the ideal unit for smaller working areas, offices, etc.

"Buffalo" UNIT HEATERS



## *Your key* TO BETTER BUCKET PERFORMANCE

When you reeve an Industrial Brownhoist Bucket on your crane you're going to see action! You'll see materials moved faster and, more important, see costs go down. The reason is simply that Industrial Brownhoist Buckets are better built . . . they've got the speed, power and strength to turn out a bigger day's work, every day.

Are you handicapping your crane and operator with a bucket that is a "cripple?" It is false economy. Put on a new Industrial Brownhoist Clamshell and you will get out of this equipment the real value which is in it.

Catalog 353 describes Industrial Brownhoist Rope-Reeve, Power-Wheel, Lever-Arm and Link-type Buckets, as well as the classes of work for which each is best suited. May we send you a copy?

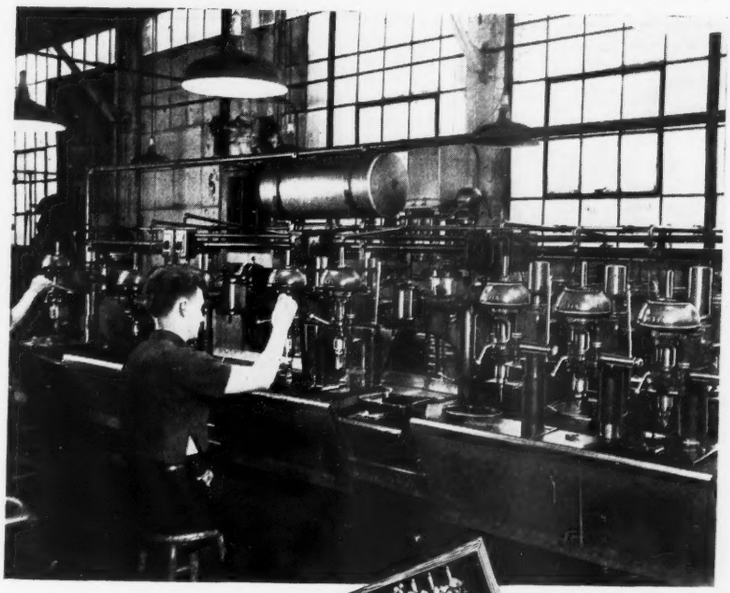
**INDUSTRIAL BROWNHOIST**

GENERAL OFFICES: BAY CITY, MICHIGAN

DISTRICT OFFICES

New York, Philadelphia, Pittsburgh, Cleveland, Chicago,

# There IS Something NEW



## IN PRODUCTION DRILLING EQUIPMENT

### Low Cost Drill Presses Are Saving Thousands of Dollars

Delta sensitive drill presses that cost less than $50.00 are doing work today that $150 drills would not handle a few years ago! They're not merely new tools—but a *new type* of tools.

Here are a few reasons why: Their first cost is less—from 50% to 75% lower than old type machines. Their maintenance cost is less—they require less power, less attention because of their sealed-for-life ball bearings and V-belt drives. They are flexible and in most cases portable. They can be moved around to fill in "waiting time" and meet changes in the production line. They can be adapted economically for special set-ups for special jobs.

They do precision work and have made remarkable production records—giving years of continuous satisfactory service!

**SEND FOR DRILL PRESS BOOK**

Mail coupon for latest Delta Drill Press Book. It contains specifications and prices of complete line of Delta Drill Presses plus details on individual parts from which you can make your own low-cost assemblies.

**DELTA MFG. CO.** (INDUSTRIAL DIVISION)

642 E. VIENNA AVE., MILWAUKEE, WISC.

DELTA MFG. CO. (Industrial Division)
642 E. Vienna Ave., Milwaukee, Wis.

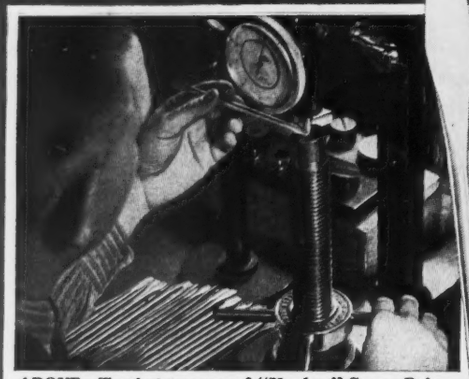
Gentlemen: Please send me your latest Delta Drill Press book which contains specifications and prices of your complete line of Drill Presses.

NAME .....

Address .....

City .....State.....

# "YANKEE" TESTED BLADES



ABOVE—Testing temper of "Yankee" Screw Driver Blades with Rockwell Diamond Penetrator, to keep continuous check on accuracy of heat treatment.

BELOW—Testing "Yankee" Screw Driver Blades against bending or breaking on the edge—each and every blade, of the hundreds of thousands . . .

## "YANKEE" MAKES THESE TESTS

of each and every blade, because the "Yankee" Screw Driver you buy must *stand up* and pay you in shop work. "Yankee" blades can't twist or break; or loosen in handle.

*No.90.*–Standard: 15 sizes, 1½" to 30" blades.
*No.95.*–Cabinet: 11 sizes, 2½" to 15½".

**Order From Your Supply House**
**For "Yankee" Tool Book, Write Dept. F**
**North Bros. Mfg. Co., Philadelphia**

**NORTH BROS. MFG. CO., PHILADELPHIA, U.S.A.**

*According to Safety Standards in many States.

**DAYTONS are equipped with safety shoes at no extra cost**

Now, because many states require safety shoes on all ladders not permanently attached, including stepladders, the Dayton is equipped with the new Queen Safety Shoe *at no added cost.* This remarkable new shoe is of the steel ferrule type, with easily replaceable vacuum cup rubber treads, and conforms with all state codes for specific requirements.

For double protection, use the Dayton, the original safety ladder.

*Write Dept. FM-9 for details and catalog.*

**The DAYTON Safety Ladder Co.**

**121-123 W. Third St., CINCINNATI, O.**

WHAT WOULD HAVE SAVED THIS EYE?
HOW WILL THIS LOWER OUR INSURANCE COSTS?
WHY WONT THIS MAN WEAR GOGGLES?
WHAT SHOULD A WELDER WEAR?
WHAT DID THAT LAST ACCIDENT COST?
WHEN IS DUST AN INDUSTRIAL HAZARD?
WHAT IS DANGEROUS ABOUT SAND BLASTING?

## DO YOU KNOW THE ANSWERS?

Wide awake executives — those who have their heart and soul set on *saving money* and *reducing costs* for their company will find the answers to these questions and *many more* in Cesco's new catalog.

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# "THAT J-M ENGINEER WAS RIGHT... HE *HAS* REDUCED OUR FUEL COSTS"

**...a common occurrence... duplicated in thousands of plants throughout the country. And in your plant, too, a J-M Insulation Engineer can cut fuel or refrigeration costs and provide more accurate temperature control...**

NO ONE INSULATING MATERIAL is best for every service . . . even in a small plant many different types and thicknesses are needed to meet varying requirements. Yet, because of their specialized nature, it is often difficult for the plant engineer to decide just which material will be most economical.

And that is where a Johns-Manville Insulation Engineer can help. These men are fully qualified to recommend the one *correct thickness* of the one *right material* that will serve better, more economically than any other.

With more than forty different types of J-M Insulations to choose from . . . in every desired form and thickness . . . and covering the entire temperature range, from far below zero to over 3000° F. above . . . the recommendations of a J-M Engineer are entirely unbiased. His only concern is to select those materials that will give you the greatest possible return on your investment and the most accurate control of temperatures.

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*FOR EVERY TEMPERATURE... EVERY SERVICE CONDITION*

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*3 are less trouble than 10!*

## THESE 3 EAGLE BEARING METALS

meet most bearing metal requirements

**EAGLE DREADNAUGHT**
For extreme speed and pressure conditions

**EAGLE OUTLASTA**
For medium speed and pressure conditions

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For low speed and pressure conditions

EAGLE *Controlled Specifications* protect your equipment . . . Play safe; specify Eagle Bearing Metals. Minimize trouble and costly shutdowns with these clean, primary metals, scientifically alloyed to lengthen life. No hard spots to cut or score the shaft. Sold through recognized distributors.

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*Reliable!*

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Unit heaters — for ceiling suspension available in 32 sizes and capacities from 18,000 BTUs to 700,000 BTUs per hour.

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Blast Units—encased for direct connection in air ducts, to be used in heating or cooling systems.

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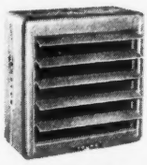
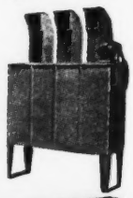


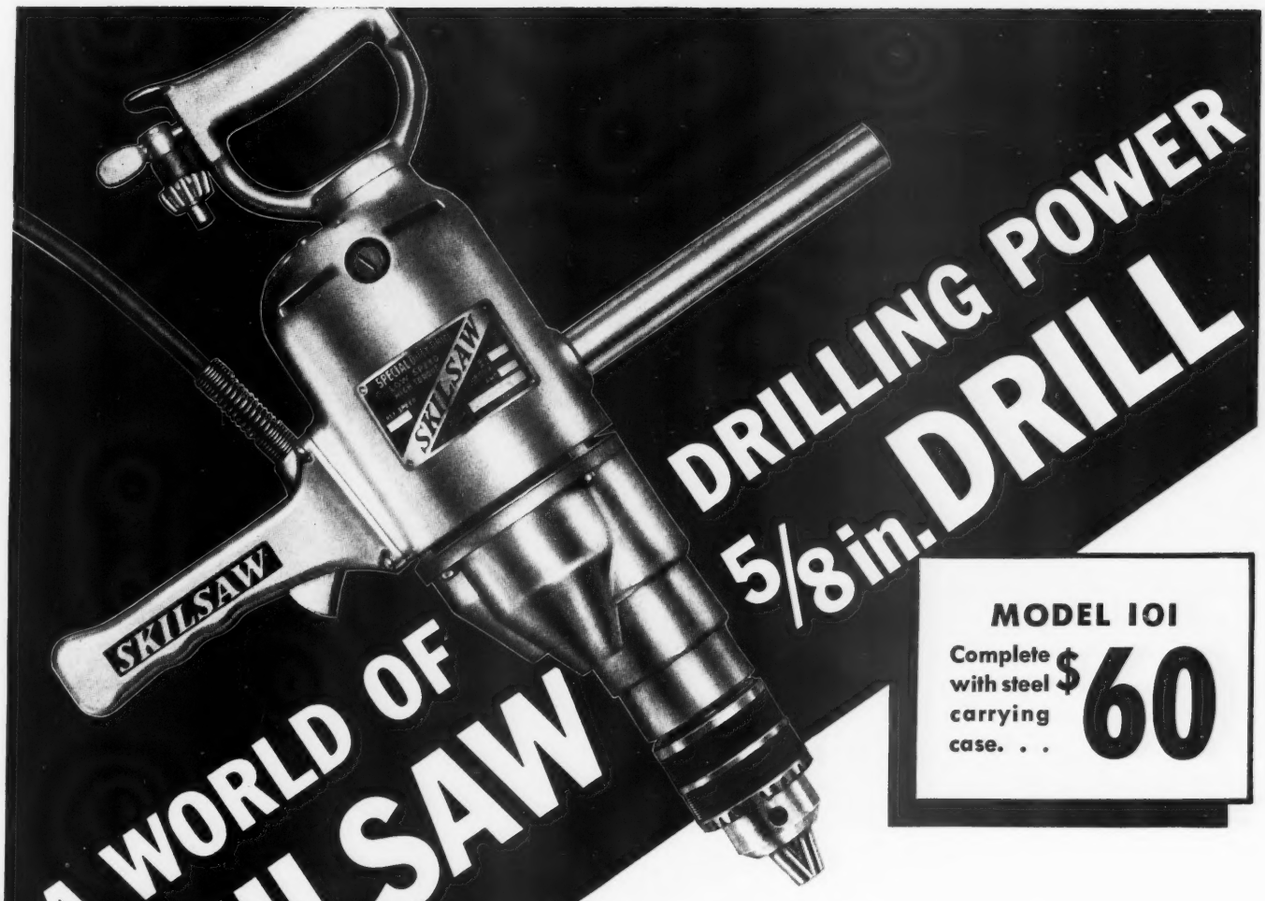
Suspension Type Unit Heaters



Floor Type Unit Heaters

Heating—Cooling Surfaces

YOUNG RADIATOR COMPANY
RACINE . WISCONSIN
Young Quality



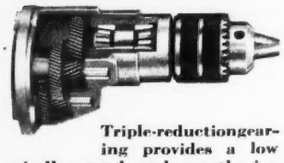

# A WORLD OF DRILLING POWER IN THIS SKILSAW 5/8 in. DRILL

**MODEL 101**
Complete with steel carrying case. . . **$60**

Just pull the trigger on this SKILSAW 5/8 INCH DRILL, see it go right through the toughest job you have—and you'll *know* that here is the tool for your work and the biggest drill value on the market!

It's easier to handle than you'd expect because it's lighter and more compact—and it packs plenty of wallop, even when you occasionally make it tackle a ¾ in. hole! Engineered and constructed to give many years of trouble-free performance. Drives hole saws for cutting holes up to 4 in. in metal, wood and compositions.

## ...and here's the reason why!



Triple-reductiongearing provides a low spindle speed and greatly increased torque—maintains plenty of drilling power even under heavy loads! Timken tapered roller bearings on spindle insure smooth drilling.

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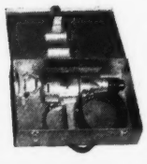

More convenience in going from job to job . . . protection against dirt or dust when not in use . . . security against damage and breakage.

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## BUILD GOOD WILL

**Cost No More**

YOU pay for the time your employees *waste* in washrooms, as well as for working time. Inefficient arrangement, poor fixtures, a limited supply of towels—any or all of these things cause delay, loitering, eat up overhead.

The Scott Washroom Advisory Service can help you plan washrooms to cut costs in terms of time saved and increased good will. It will indicate how, within your present budget, washrooms can be made a constructive feature of *practical* industrial relations.

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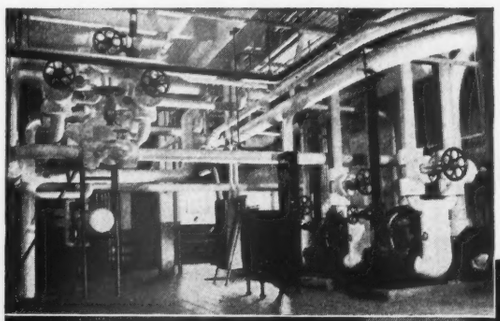
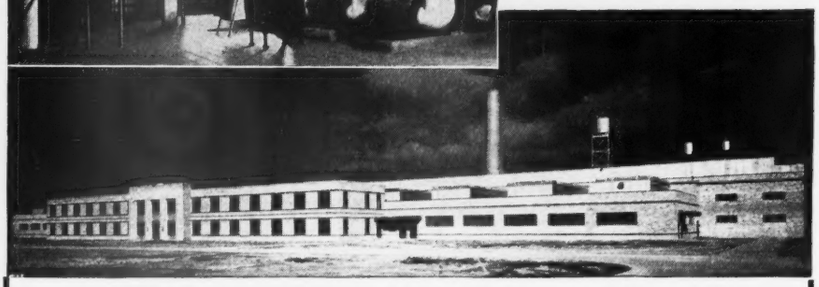
## Has Miles of *Carey* INSULATED PIPING





The Industrial Rayon Corporation's new $11,500,000 plant at Painesville, Ohio, incorporates revolutionary methods of production and advanced features of building construction never before utilized on so tremendous a scale. This new marvel of industrial efficiency makes extensive use of Carey 85% Magnesia and other Carey high-efficiency products.

Whatever your insulation problems, Carey can help you solve them. A national organization, with 66 years of manufacturing experience, is at your service. Write Dept. 31 for Insulation Catalog.

**THE PHILIP CAREY COMPANY • Lockland, Cincinnati, Ohio**
*Dependable Products Since 1873*
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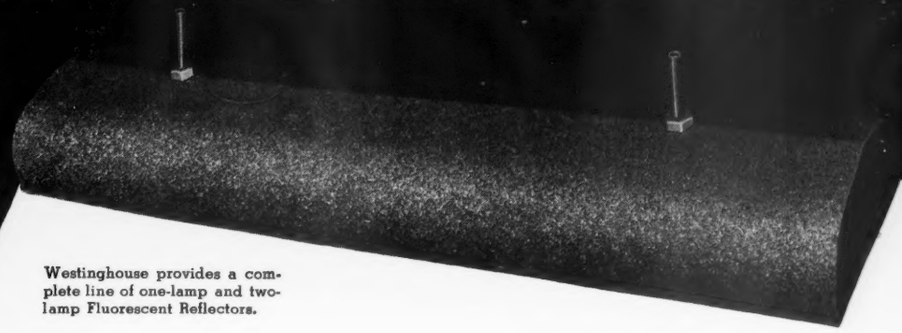
# *Daylight at any hour . . . with*
# FLUORESCENT LUMINAIRES



Westinghouse provides a complete line of one-lamp and two-lamp Fluorescent Reflectors.

## FOR INDUSTRIAL APPLICATIONS

Here is science's rival to daylight . . . with an extended light source for wide industrial applications. Here is far greater efficiency than any other kind of illumination for interior lighting. Here is low brightness for minimum glare — 3½ candles per square inch from a 1½ inch Fluorescent Tube of 40 watts. Here is a 50 per cent cooler light than any incandescent source . . . and unusually long life.

All 48-inch units for 40-watt lamps are available in one or two lamp fixtures with spread or concentrating reflectors. Reflectors are finished by the Alzak Process for greater permanence and easier maintenance.

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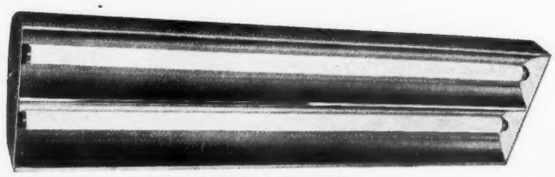
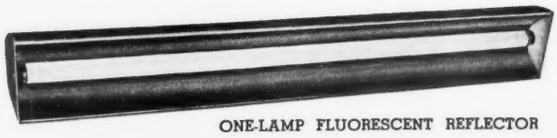
For the first time, factories, stores, museums and other users demanding color corrections may have accurate color rendition without heavy light loss through filters. Where goods must be matched in tone, Fluorescent units will be found the correct type of illumination. All Westinghouse Fluorescent units are equipped with suppressors to eliminate radio interference.

*For full details call your local Westinghouse distributor, or address Westinghouse Electric & Manufacturing Company, Lighting Division, Edgewater Park, Cleveland, Ohio.*



TWO-LAMP FLUORESCENT REFLECTOR



ONE-LAMP FLUORESCENT REFLECTOR

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For ideal general plant illumination, Westinghouse provides the exclusive Locklite Reflector line for incandescent lamps. This new connecting principle cuts maintenance costs . . . is safer . . . gives complete interchangeability of seven reflector types. Locklite lights as it locks. Whether or not your plant is in line for a modernized lighting system, be sure to investigate Locklite.

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# Make that stairway a SAFEWAY with BLAW-KNOX *Electroforged* STEEL GRATING

Safe stairways and open flooring also bring light and air to your plant. Blaw-Knox electroforged stair treads with rolled diamond checkered nosing are designed to stand terrific impact. The twisted cross bar an exclusive Blaw-Knox Safety feature provides non-slip footing—Blaw-Knox electroforged steel grating means super-strength flooring with maximum open area. Read the 5 "star" points below, then send for free paper-weight sample.

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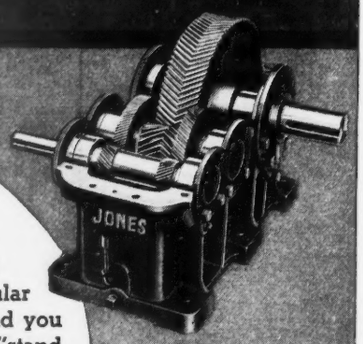
# *Your kind of* SPEED REDUCERS




**WHEN** you want a speed reducer you want the type that will best handle your particular drive problem . . . and you want a reducer that will "stand the gaff." Jones reducers measure up to both standards.

It makes no difference whether you require herringbone, spur or worm gear reducers, the Jones organization can give you just what you need in any ratio and capacity . . . and over the years Jones reducers have shown the ability to "take it" under the most severe operating conditions.

Jones offers your kind of speed reducers to solve your kind of drive problems.

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—of the bulletin "In the Service of Industry" which presents interesting information about speed reducers and other transmission products.

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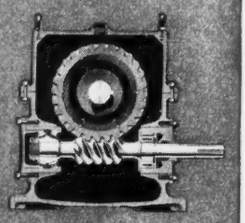
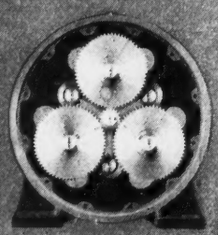
Ratios 1¼ to 1 up to 300 to 1 in capacities from 1 to 400 H.P.



**Worm Gear Reducers**
Ratios 4 to 1 up to 90 to 1 in capacities from ¼ to 100 H.P.



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*Since 1890*

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CUT AND MOLDED TOOTH GEARS — V-BELT SHEAVES
ANTI-FRICTION PILLOW BLOCKS — PULLEYS
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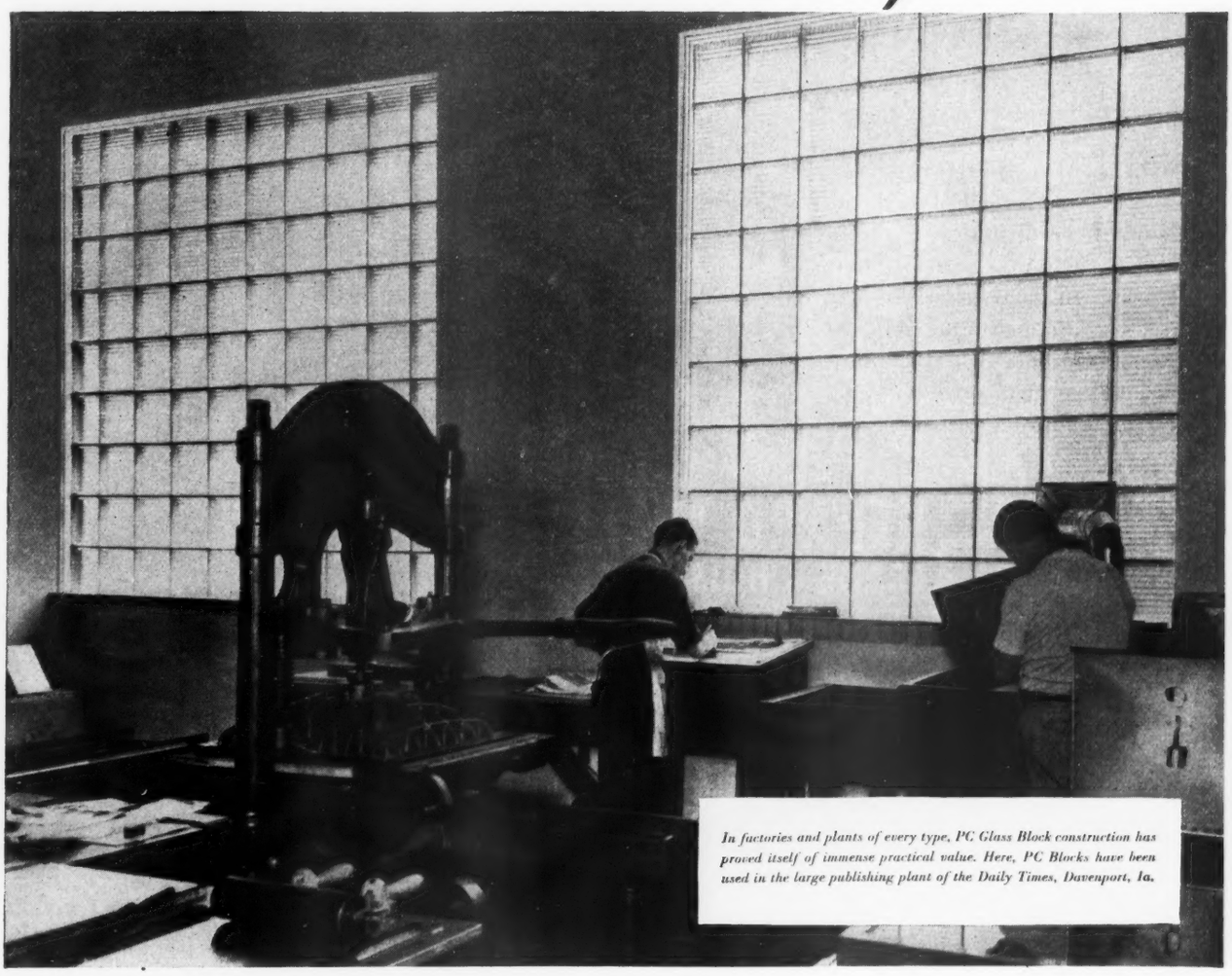
# *How* TO FACILITATE PRODUCTION... AND *Save money*, TOO!



*In factories and plants of every type, PC Glass Block construction has proved itself of immense practical value. Here, PC Blocks have been used in the large publishing plant of the Daily Times, Davenport, Ia.*

THE use of PC Glass Blocks in factory buildings has proved the cure for a number of manufacturing headaches.

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PC Glass Blocks will save you money, too. No wood or metal sash to replace or repaint periodically. Easy cleaning. Lower fuel bills. Send coupon for free book. PC Glass Blocks are manufactured by Pittsburgh Corning Corporation.

*At the New York World's Fair, see the exhibits of Pittsburgh Glass in the Glass Center Building, the Forward March of America Building, and the Pittsburgh House of Glass. At the Golden Gate International Exposition, see the Pittsburgh exhibits in the Homes and Gardens Building.*

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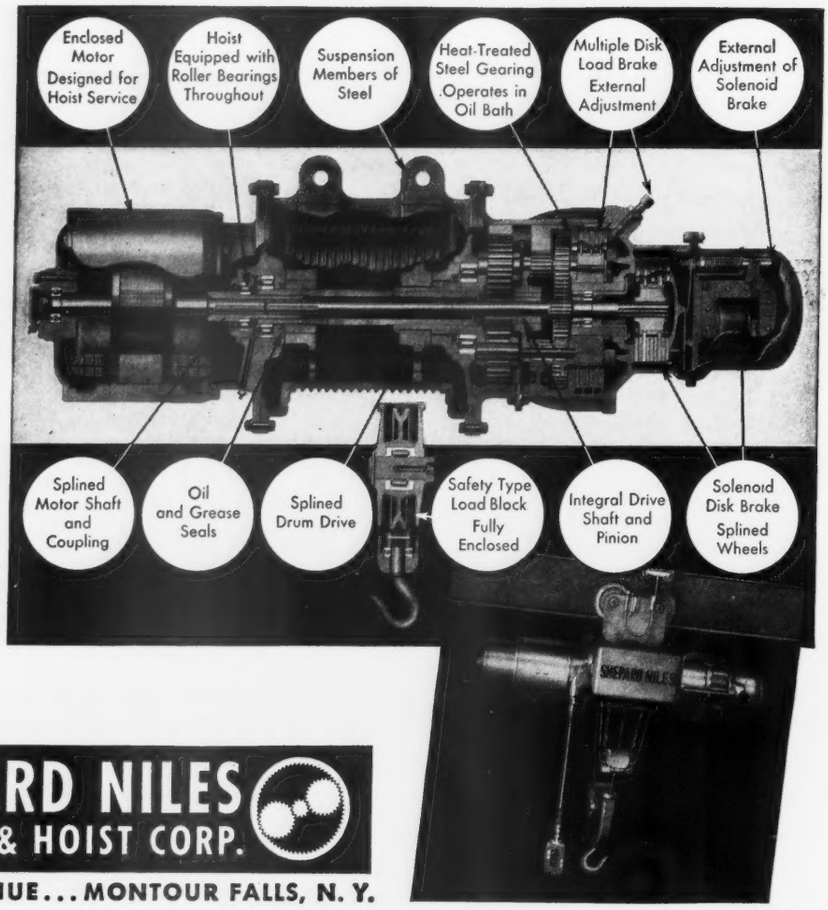
It is available in a wide range of types and sizes. For typical applications and more complete information write for Bulletin No. 126.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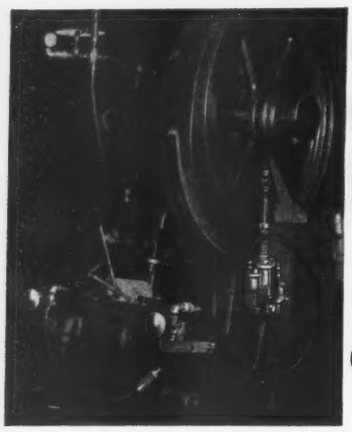

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Repeat-type presses can be operated as single-action presses without clutch conversion, with the Schrader No. 9576-A Press Safety Control. Workmen must use both hands to operate the twin control valves, thus eliminating many of the most common causes of machine accidents. No foot operation is involved. Installation of the Schrader Control involves no changes in machine construction. The total cost is far less than for the usual clutch changeover.

*Send for catalog No. 305 which describes the Schrader No. 9576-A Safety Control and the complete line of Schrader Air Accessories.*

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Most complete line of forged steel couplings for all drives, all loads. Advanced design and construction improvements insure trouble-free operation. Low initial cost. Write for catalogs giving sizes, service factors, prices. No obligation.

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If you returned from vacation with a sunburned, peeling, dehydrated hide, you have a faint idea of the insulation-wrecking baking that wiring takes in temperatures ranging from 150° to 250° F. and higher.

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*Also refer to Electrical World Buyer's Reference*

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No racketeer can boast of a "take" anywhere near what vibration costs modern industry. No gangster is more relentless in his demands upon the nation's industrial wealth than this invisible high-jacker.

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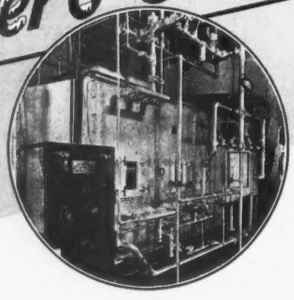
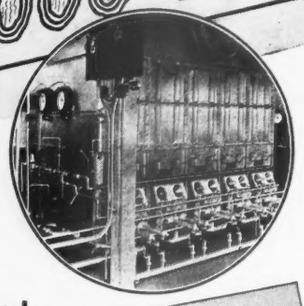
KORFUND VIBRATION CONTROL **KORFUND** KORFUND VIBRATION CONTROL

48-25 32ND PLACE **COMPANY, INC.** LONG ISLAND CITY, N. Y.

*Specialists in* VIBRATION CONTROL *for 30 years*

# Zero Cold or 1000° Heat





the air can be supplied with

## ROSS Air Systems

Hundreds of exacting processing operations are not only being successfully completed with ROSS pure air systems, —but with far greater uniformity of production. They are designed for maintaining any temperature—from zero to 1000°F. It it's a job for AIR—it's a job for ROSS Air Systems. What's your problem?

BAKING
DRYING
CHILLING
REFRIGERATION
AIR CONDITIONING
DEHUMIDIFICATION

J.O.

## ROSS ENGINEERING CORPORATION

350 MADISON AVE., NEW YORK, N. Y.

CHICAGO, ILL. DETROIT, MICH. PITTSBURGH, PA. PORTLAND, ORE.

ROSS ENGINEERING OF CANADA, LTD., Dominion Square Building, Montreal

# Do You Read a Routed Copy?

If you are on a route list to read Factory Management and Maintenance, you probably pass it along without having the chance to read just the article that you would like best. Routed copies have a knack of arriving at inconvenient times—late—and often in poor condition.

Why not have your own copy delivered to you each month? Then you could read at your leisure—and while the news is still hot. A subscription costs only $3.00 per year. Send in yours now.

**FACTORY MANAGEMENT *and* MAINTENANCE**

330 West 42nd Street
New York City

# SAVE TIME
# SAVE STEPS
# SAVE MONEY

1. Lamson Dispatch Tubes reduce employes' time away from machines and desks
2. Eliminate need for walking between departments, floors, buildings
3. Cut messenger staffs and speed the flow of orders and all routine papers

## USE TUBES
*for Carrying:*

**ORDERS**

—from order department to shipping
—from order department to sales
—from order department to credit
—from order department to planning
—from order department to finished stock

**ROUTINE PAPERS**

between mail department » » » orders » » » sales » » » engineering » » » experimental » » » blue print » » » finished stock » » » raw stock » » » purchasing » » » tool room » » » receiving » » » patterns » » » service » » » shipping » » » cost » » » billing » » »-employment » » » payroll » » » manufacturing.

**JOB TICKETS**

—from central desk to foremen's offices
—from central desk to factory departments
—from planning department to stock rooms
—from planning department to foremen's offices

**SMALL TOOLS AND LABORATORY SPECIMENS**

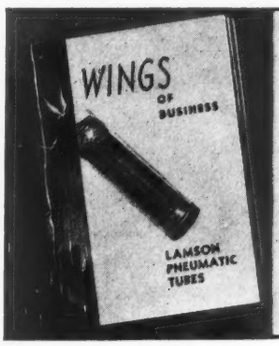
—from tool rooms to manufacturing departments
—from furnaces to laboratories
—from receiving dock to laboratories
—from mine levels to laboratories
—from processing rooms to laboratories
—from manufacturing departments to laboratories

PRODUCTION costs are geared as truly to movement of tool requisitions, job tickets and orders as they are to movement of materials. You pay as much for 15 minutes waiting for an order as you do for 15 minutes working on that order.

All over the country, plants in various lines of industry are solving their paper-handling problems with Lamson Dispatch Tubes. These fast, handy tools of modern industry keep men at their machines and desks. They carry messages, orders, tickets, blueprints, small tools and laboratory samples from department to department . . . from floor to floor . . . and from building to building. No waiting at time desks or tool rooms. No papers held up between periodic messenger calls. Smaller messenger staffs.

Many plants have written off the entire cost of installation in savings alone during the first year. You can start with a single tube if you want to. Get the facts today. Write for a free copy of the valuable book, "Wings of Business."

# LAMSON
*makers of*
## DISPATCH TUBES
*and Conveyors of All Types*




The LAMSON COMPANY, INC.
Syracuse, N. Y.

Send me a Free Copy of your 28-page Pneumatic Tube booklet, "Wings of Business".

*Name* .....

*Company* .....

*Address* ..... *State* .....

# Quiet!

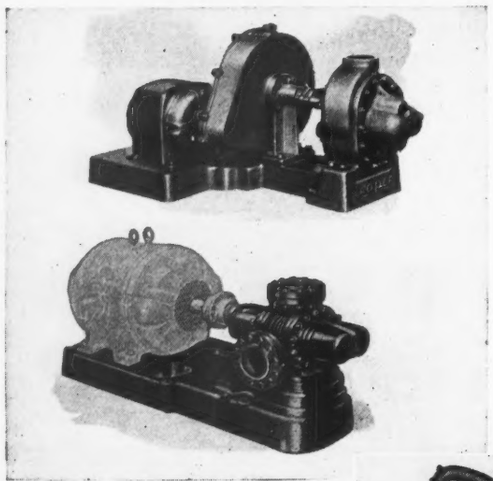
Yes, Roper Pumps are quiet . . . quiet because they are engineered right and built right . . . quiet because they have been simplified to the 'nth degree . . . quiet because they have only two moving parts.

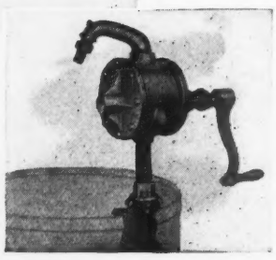
But it's not surprising that Roper Pumps are smooth performers when you realize that we have been building pumps for 82 years. And it's not surprising that we have a complete line for all industrial purposes at prices that definitely set a new high for pump values.

We would like to have you know more about Roper Pumps . . . why they are most efficient . . . why they operate with the lowest power consumption . . . and why they are the best buy for you.

*Will you write for Bulletin F-511?*

**GEO. D. ROPER CORP., ROCKFORD, ILLINOIS, U.S.A.**





**ROPER**

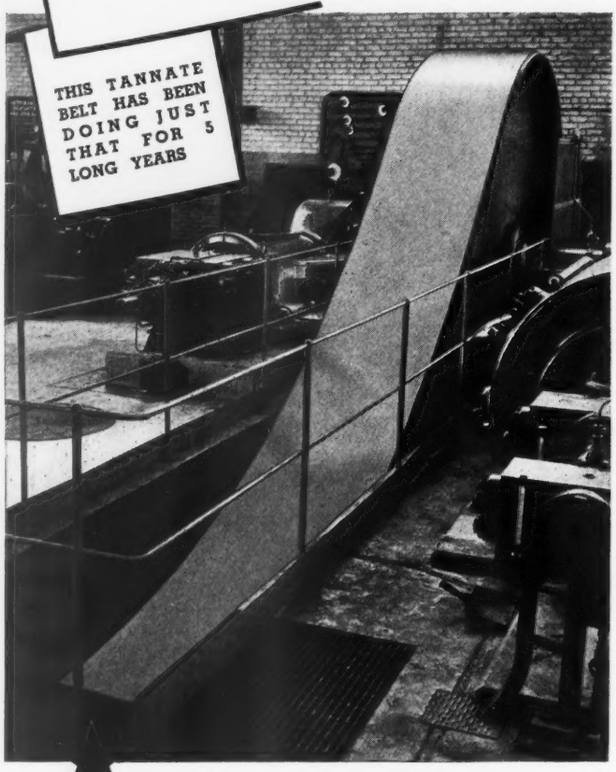
*Rotary* **PUMPS**

**DEPENDABLE SINCE 1857**

# *Suppose you could*

- *reduce slip*
- *increase transmitted H.P.*
- *eliminate time losses*
- *reduce maintenance costs*

*. . . wouldn't it pay?*




RHOADS TANNATE

**This 79′ x 36″, four ply TANNATE LEATHER BELT operates on a mixed gas compressor at a speed of 6100 ft. per minute, transmitting 600–800 horsepower. The oak tanned belt formerly used here slipped badly, grew progressively worse until it carried but a fraction of the load. And, it had to be repaired on the average of once every four days!**

**The TANNATE Belt has run with minimum slippage since the first turn more than 5 years ago! Not one minute's shut-down for repairs has been necessary in all this time! And, the only maintenance has been an occasional dressing applied while running!**

**Wouldn't it pay you to put TANNATE to work? This is no exceptional performance; if you have a balky, inefficient drive TANNATE's the belt to conquer it!**

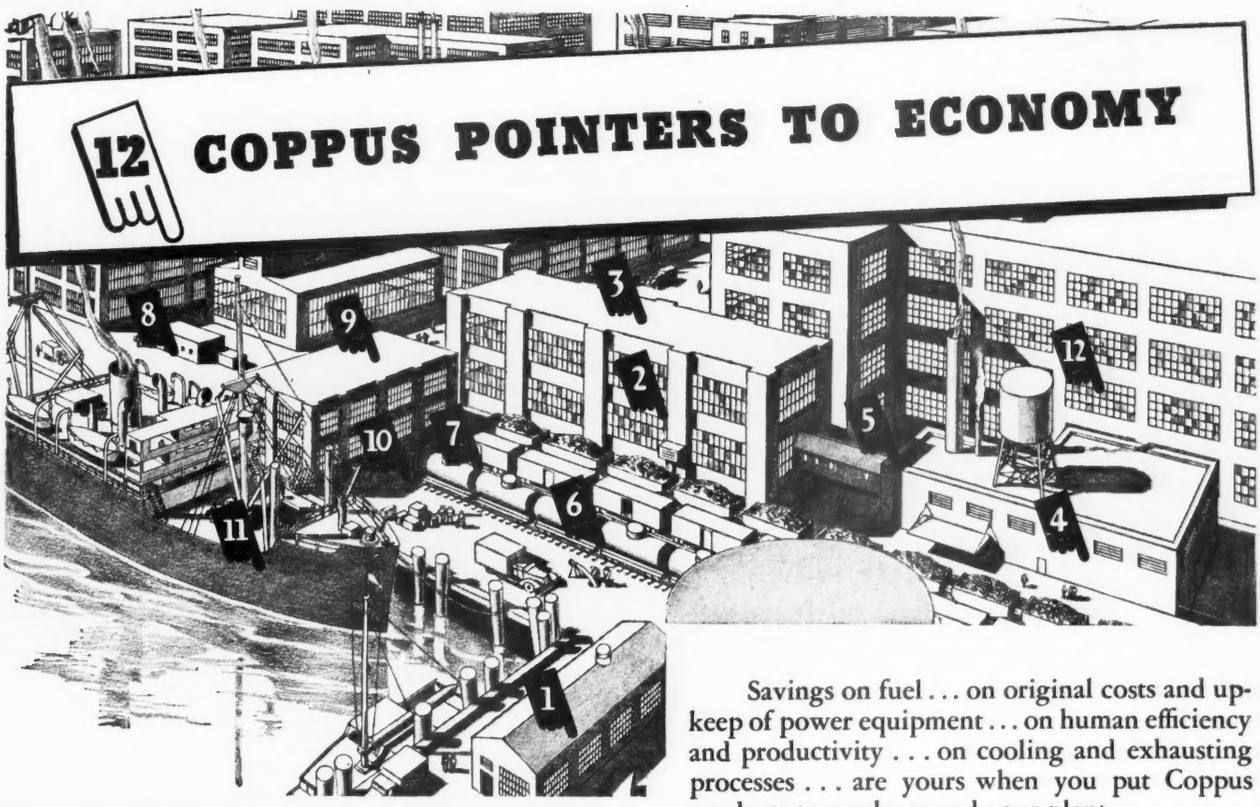
## J. E. RHOADS & SONS

*Established 1702*

**35 N. SIXTH ST., PHILADELPHIA, PA.**

**NEW YORK CHICAGO ATLANTA CLEVELAND**
**FACTORY AND TANNERY AT WILMINGTON, DELAWARE**

# 12 COPPUS POINTERS TO ECONOMY

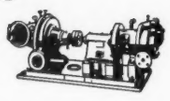



Savings on fuel . . . on original costs and upkeep of power equipment . . . on human efficiency and productivity . . . on cooling and exhausting processes . . . are yours when you put Coppus products to work around your plant.

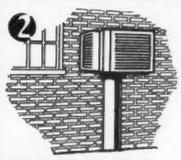
Special new type, higher efficiency, natural gas burners; also all kinds of blowers, fans, ventilators for men and machines; steam turbines of just the size you need for each small job; etc.

Designed in the first place to fit the general needs of your industry, Coppus builds these products particularly to meet *your* conditions.

Send for free bulletins giving full details on the ways *you* could save — noting your special interests among the applications pictured alongside this text.

1 

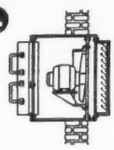
**BLUE-RIBBON STEAM TURBINES**—6 sizes up to 150 H.P. Prices in line. Horizontal, vertical, or with built-in speed reducers.

2 

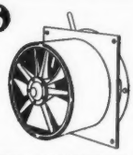
**COMPRESSOR FILTERS**—Recommended by manufacturers who supply over 90% of the country's compressors and engines.

3

**STATIONARY UNIT AIR FILTER**—95.6% efficient against 2 micron-size silica dust. Highest U. S. commercial rating.

4 

**VENTILATOR FILTERS**—Combination ventilator-filter unit for laboratories, instrument assembly rooms, etc.

5 

**NATURAL GAS BURNERS**—Coppus-Dennis Fanmix for industrial applications. Pinwheel action produces perfect gas-air mixture.

6

**CABLE MANHOLE VENTILATORS**—Fast ventilation of *any* confined space. Electric motor or gasoline engine driven.

7

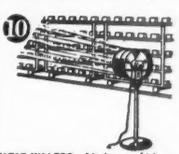
**TANK AND TANK CAR VENTILATORS**—Supply clean, cool air to men working. On cars — attachable to nipple if desired.

8

**BOILER MANHOLE BLOWERS & EXHAUSTERS**—swift cooling and ventilating of boilers, tanks, retorts, etc.

9

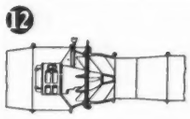
**MANCOOLING FANS**—Keep production up by keeping men cool. No stale air-recirculation. Air is *directed*.

10 

**HEAT KILLERS**—High speed blasts for cooling and drying furnaces, motors, generators, *products*, etc.

11

**SHIPHOLD VENTILATORS**—For exhausting welding fumes and other injurious gases from confined working spaces.

12 

**VANO BLOWERS**—Fitted to meet any special air problems where ordinary fans fail. They are *most* efficient.

# COPPUS

**COPPUS ENGINEERING CORPORATION**

**375 Park Avenue, Worcester, Mass.**

CHECK ✓ NUMBER OF APPLICATIONS

| | | | |
|---|---|---|---|
| 1 ☐ | 4 ☐ | 7 ☐ | 10 ☐ |
| 2 ☐ | 5 ☐ | 8 ☐ | 11 ☐ |
| 3 ☐ | 6 ☐ | 9 ☐ | 12 ☐ |

*Mail in for free Bulletin*

DESIGNED FOR YOUR INDUSTRY — ENGINEERED FOR YOU

# Keep Heating Costs and Sick Leave Costs Down with

REVOLVING DISCHARGE
Floodlights of Heat

# Wing
## Featherweight UNIT HEATERS

This new heater with a discharge outlet that slowly revolves introduces an entirely new and scientifically correct principle of distributing heat even to the walls and remote corners of the plant.

It creates a state of air turbulence that had long been sought but never before achieved which results in a constant yet practically imperceptible motion of properly warmed, healthful and comfort-giving air.

One user, in comparing the results achieved by an installation of these new units with other types said "They produce an entirely new sensation of comfort—the air in here feels alive and invigorating."

**Send for Bulletin H-6 AB**

*Distributes heat even to the walls and remote corners of the plant.*

WORKING AREA

HEALTHFUL LIVE HEAT OVER YOUR ENTIRE WORKING AREA

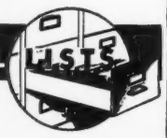
## L. J. Wing Mfg. Co.

MFR'S OF

162 W. 14th STREET NEW YORK, N. Y.



McGRAW-HILL
# DIRECT MAIL LISTS



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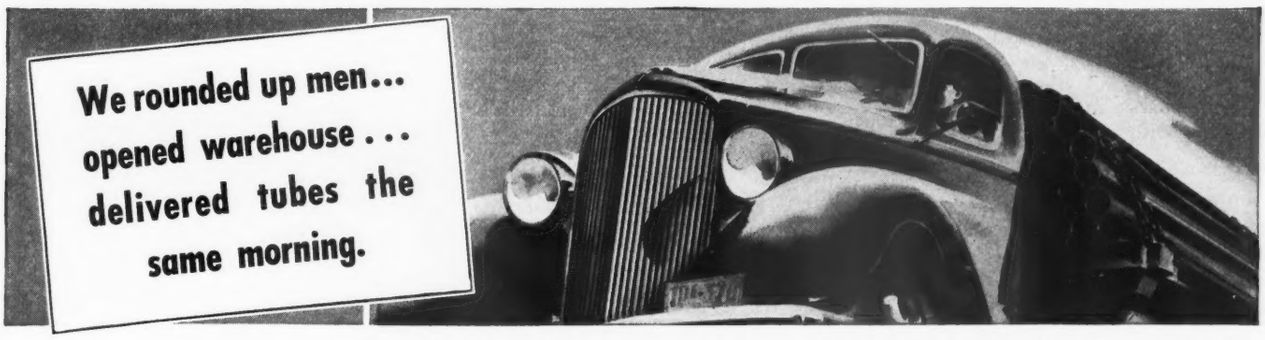
*. . . Complete Lists Covering Industry's Major Markets*

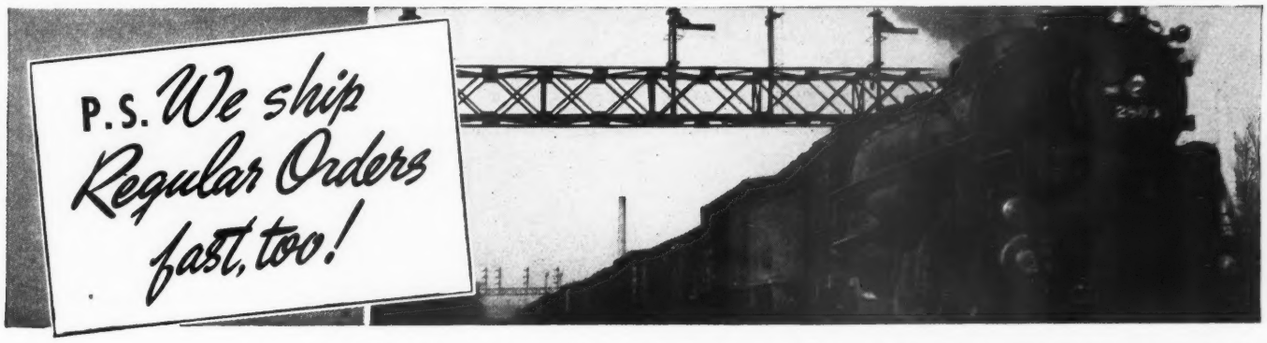
# When you re-tube boilers . . .

## *remember Scully!*

One Sunday morning the phone rang at the home of one of our Chicago men. A frantic customer was on the line—a boiler had broken down. Immediate repairs were imperative. Could we help?




We could and did. Men were sent to the warehouse and the necessary NATIONAL Seamless Boiler Tubes were delivered that same morning. This prompt action saved the owner expense and trouble.




But that's just a sample of Scully Service in an *emergency*. Regular orders always get quick action, too. For it is the rule at each of the eight Scully Warehouses to assume that our customers want prompt service always—no matter how large or small their order may be. And our customers have learned that they can *always* depend upon Scully for prompt, reliable, friendly service.

When you need boiler tubes—call Scully. And call Scully, too, for whatever you need in steel, steel products, copper and brass. Ask for the Scully Stock List and Reference book. It's free.

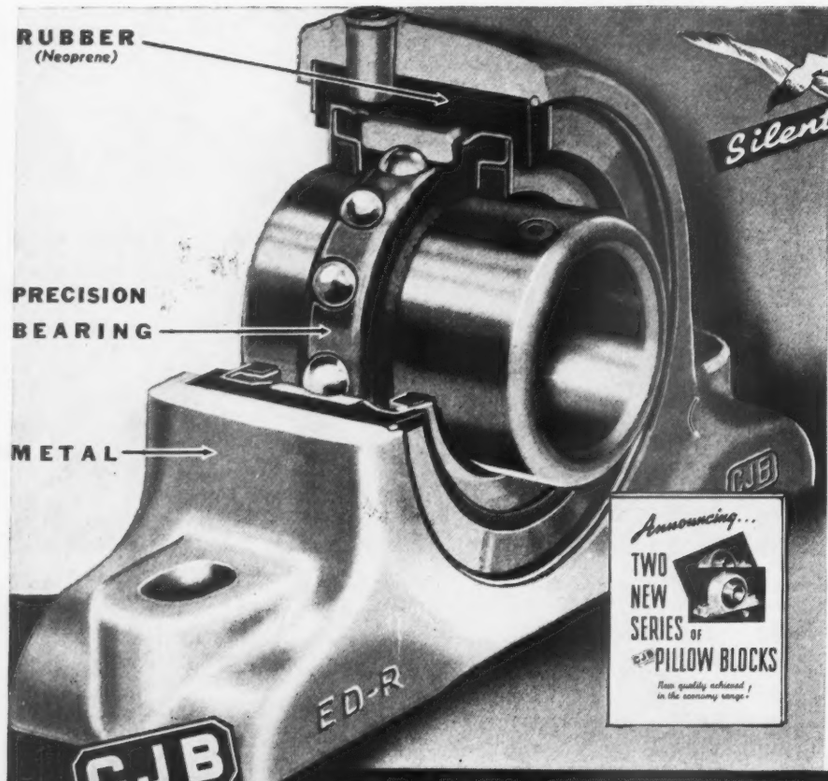
USS Scully Service

**SCULLY STEEL PRODUCTS COMPANY**

*Distributors of Steel, Steel Products, Copper and Brass*
*Warehouses at*

CHICAGO · NEWARK, N. J. · ST. LOUIS · BOSTON · ST. PAUL—MINNEAPOLIS
CLEVELAND · PITTSBURGH · BALTIMORE

UNITED STATES STEEL




# RUBBER (Neoprene) *Insulated*

This sound-insulated ball bearing pillow block, developed by Ahlberg, provides silent anti-friction efficiency. It is the ideal light duty bearing for air-conditioning equipment, fans, furnace blowers, etc.

Its precision, quiet-running CJB bearing is completely cushioned from the all-metal housing with Neoprene, newest synthetic rubber, which is impervious to oil. Frictionless, labyrinth-type seals, also of Neoprene, provide real protection for the bearing.

Silence is the word on this new pillow block. Cost is very reasonable. Write for the Bulletin (shown at left) for complete details and prices.

**AHLBERG BEARING COMPANY**

Manufacturers of CJB Master Ball Bearings
3013 WEST 47TH STREET, CHICAGO, ILLINOIS

## PILLOW BLOCKS

**SEE US at the MACHINE TOOL SHOW IN CLEVELAND OCT. 4-13, BOOTH 2115**

---

## SPEAK LOUDER—LOUDER!

## Stop phone mistakes this simple, sure way

● Telephone mistakes are errors in hearing . . . errors caused by factory racket. Learn how hundreds of factories have solved this telephone service problem with Burgess Acousti-Booths. One manufacturer has 32 Acousti-Booths in service. It will pay you to learn about this booth.

*Send for Bulletin 128 today!*

All the facts are in Bulletin 128, sent FREE on request. Learn how this acoustically engineered booth blots up noise, makes telephoning easy. Bulletin 128 gives you illustrations of 4 models, descriptions, prices, specifications, list of users. *Get the Acousti-Booth Bulletin 128 NOW and learn how to improve plant telephone service.*

*See 4 Models*

*Burgess Acousti-Booths blot up noise. You talk and hear in quiet. Learn how Acousti-Booth does it. Send the coupon.*

*Send this coupon for Free Acousti-Booth Bulletin 128*

Name _____

Firm _____

Street, City _____

Burgess Battery Company, Dept. F, 500 W. Huron St., Chicago

*Manufacturing under Burgess Patents*

**BURGESS**

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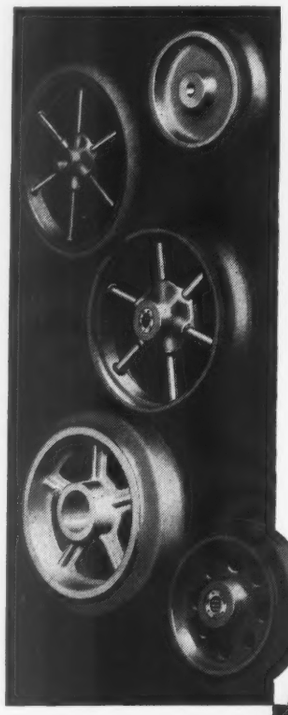


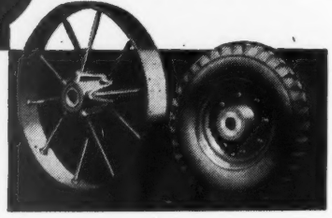
# EWC TRAILERS

## *save Trucks, Floors*

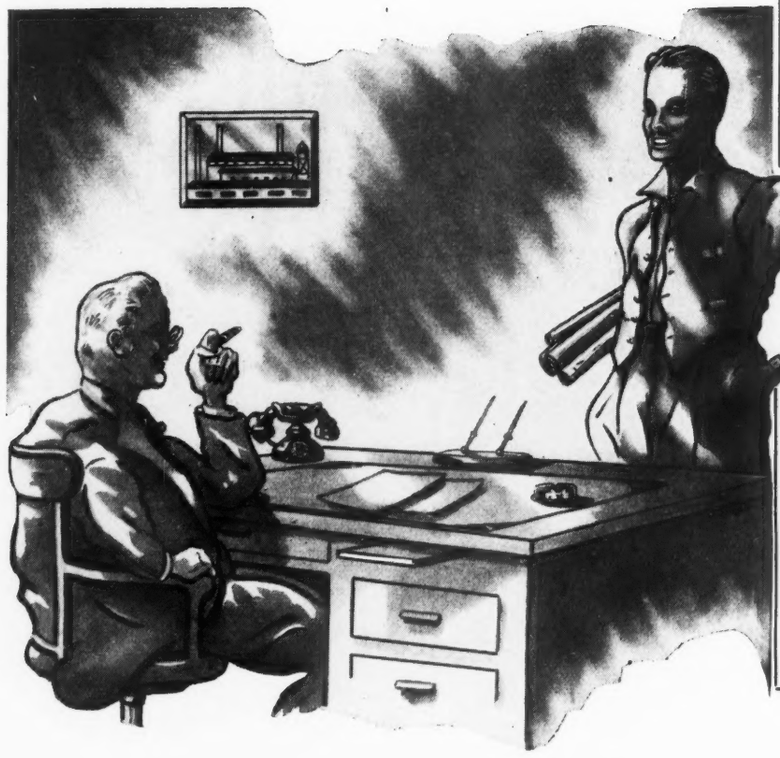
EWC Rubber Tired Wheels on your trucks or tractors will double their life . . . reduce floor maintenance and repair costs . . . speed up materials handling with complete safety . . . insure more truck-miles per man-day or tractor-day . . . save power. And more . . . noise is completely abolished.

There's an EWC wheel for almost every application. They're made to fit old axles, or furnished with new axles and roller bearings.

Whether you're interested in modernizing a single truck or trailer, or an entire fleet, it will pay you to WRITE FOR LITERATURE and PRICES.

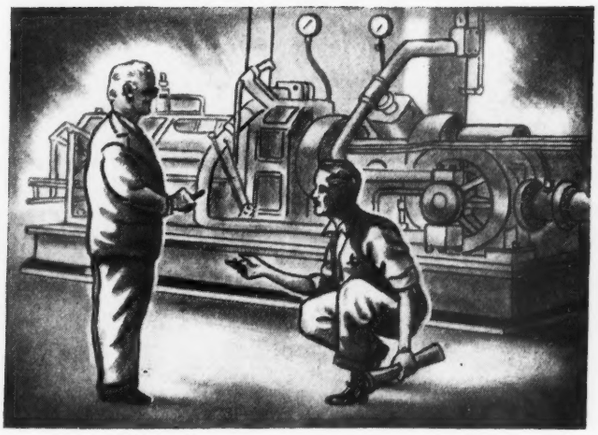


**ELECTRIC WHEEL COMPANY**
DEPT. FA
QUINCY, ILLINOIS



# Not An Exaggeration T. J.!

PLANT SUPER: I'm especially pleased with the installation we made of Felters Certified Unisorb under our machinery to correct the vibration transmission we've been troubled with for years, T. J. Come out in the shop and I will show you the change.



Plant Super: The whole shop is quieter, easier on the operator's nerves and much easier on the parts of the machines that were wearing out so fast. The installation also shows a step-up in production, T. J. T. J.: Surely I can understand that repair bills ought to be lower but aren't you exaggerating a little on that increased production idea?

Plant Super: It is not an exaggeration, T. J. because machines relieved of dynamic stresses by setting them on resilient Unisorb pads can work better and faster without undue wear. Operators also are more efficient due to less noise and less vibration playing on their nerves.

*Send for our fully illustrated booklet telling of many of the installations we have made to date. It may mean increased production in your plant.*

*Look For* CERTIFIED FELT Made by The FELTERS COMPANY INC. Tested under the supervision of our own Laboratory *This Label*

**THE FELTERS COMPANY, INC.**

210 SOUTH ST., Dept. AB • • BOSTON, MASS.

OFFICES: New York, Chicago, Philadelphia, Detroit, St. Louis, Dallas, San Francisco

MILLS: Johnson City, N. Y. • Millbury, Mass. • Jackson, Mich.

# HERE'S AN INDUSTRIAL VACUUM CLEANER YOU SHOULD *know about*

This Invincible Machine is designed primarily to do a far better job of "plant housekeeping" than is possible with old-fashioned methods, and at much lower cost. It does just that, as evidenced by its effective use in thousands of plants. It saves time and labor . . . it prevents damage . . . and it improves working conditions.

## *You should know:*

**1** that it is not a huge, awkward machine. It is light, compact, and easy to use. It even follows the operator by a slight pull on the hose, and this saves lots of time.

The "Invincible" cleans floors, walls, pipes, beams, shelves, bins, conveyors, and every nook and corner.

**2** that despite its unusual portability it is ruggedly built and is designed to "take it"—will actually withstand years of constant, 24-hour-a-day operation if need be.

**3** that it has abundant cleaning power for even "tough" cleaning jobs. Any surface from floor to roof is safely and thoroughly freed of dust and dirt. No dust is scattered.

This "Invincible" is bringing savings and advantages to a majority of the Country's leading manufacturers. Can it do as much for you, too? Drop us a note and get complete information.

**INVINCIBLE VACUUM CLEANER MFG. CO.**
**. . . 440 DAVIS · DOVER, OHIO**

# YOU ARE ONE

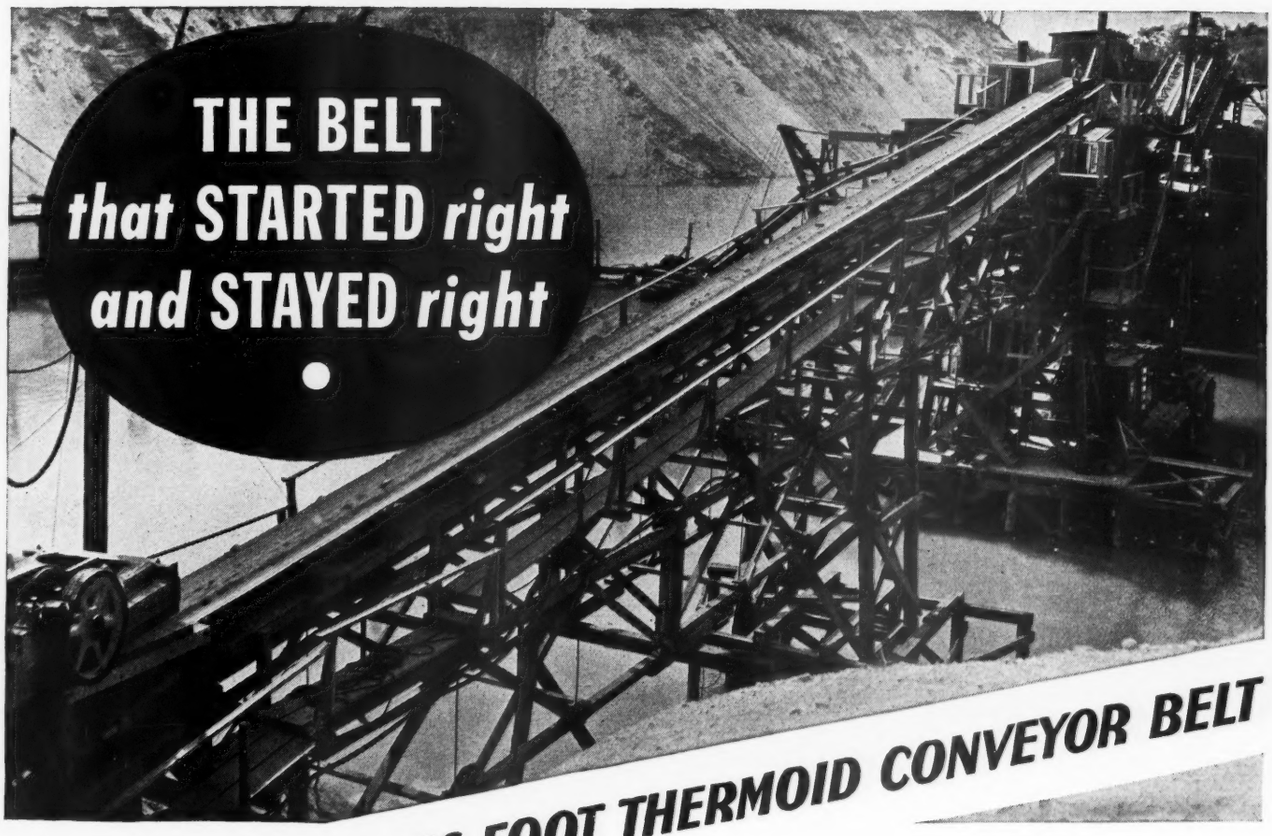
of over 25,000 subscribers to FACTORY MANAGEMENT and MAINTENANCE.

*Your* problems of plant management, production and maintenance—business or individual—are duplicated with *other* readers BUT—

Still *OTHER* readers can provide the solution of your problem *if they know what it is!*

Tell them! Through classified advertising in the Searchlight Section of "Factory"—*your* business paper and *theirs.*

*See the Searchlight Section of this issue for current "Wants" and "Opportunities"*




# THE STORY OF A 316 FOOT THERMOID CONVEYOR BELT

Actually it's a story that is far from finished, for at this point the belt is good for uncounted thousands of tons of sand and gravel.

Day in and day out it feeds the vibrating screen all the tonnage it can take . . . without interruption . . . without breakdown. And that's its record from the first minute it started. The operator reports that it was not even necessary to tighten the belt or make any idler adjustments after the installation.

So here's the moral to this "unfinished" story . . . Operators can pay a heavy penalty when they purchase conveyor belting on the basis of cost per foot, rather than calculating the cost per ton of uninterrupted service.

Through years of specialization in the field, Thermoid has developed and can offer the right type of belt for each conveying job. Each type offers the finest that quality raw materials and practical engineering knowledge can give to a belt. The result is longer service life and reduced conveying costs.

For new installations . . . or replacements . . . be sure you specify Thermoid.

**THERMOID RUBBER, DIVISION OF THERMOID COMPANY, TRENTON, N. J.**

*Standard types of belting made by Thermoid:*
Transmission Belting
Conveyor Belting
Multiple V Belts
Grader Belting
Canners' Belting
Bucket Elevator Belting

*Standard types of hose made by Thermoid:*
Air Hose
Water Hose
Steam Hose
Tank Truck Hose
Gasoline Hose
Suction Hose

**Thermoid**

BELTING · HOSE · PACKINGS · BRAKE LININGS

# NOVEMBER ISSUE TO FEATURE TESTED MONEY-SAVING IDEAS

FACTORY again, in the November issue, will bring readers a veritable reference book of ideas for reducing costs and increasing profits. This issue will be titled, "Quick Ways to Profit." FACTORY's editors have spent many months assembling experience-tested ideas gathered from hundreds of plants throughout industry. Ideas have been secured through editors' visits to plants, through cooperation of equipment manufacturers, as well as the many ideas submitted by FACTORY's readers in competition for the FACTORY awards. Similar to the November 1938 issue, "500 Quick Ways to Profits," it will incorporate a number of changes suggested by readers.

### Will Aid Review of Plant Costs

Many readers have told us how the November 1938 issue was used for conferences and department meetings to review the whole subject of plant costs. Many report sizeable savings which resulted from the adoption of ideas found in last year's issue.

### Issue To Be Sectionalized

Hundreds of comments and suggestions from readers have been studied and analyzed during the past year by FACTORY's editors, and the sectionalized presentation of ideas will again be used. November FACTORY will contain eight regular sections, as follows:

1. Materials Handling, Layout, and Motion Economy
2. Power, Heat, Light, and Air Conditioning
3. Mechanical Power Transmission
4. Electrical Transmission and Utilization
5. Buildings, Services, and Maintenance
6. Production Planning and Control
7. Production Methods and Materials
8. Employee Relations and Safety

In the issue the winners of the $500 in cash awards for the best "Quick Ways to Profits" will be announced.

### Advertising and Literature Service

An innovation in the November issue will be the classification of advertising in the same manner that the editorial is classified in order that readers may find advertising information in each section on the same subjects as covered by the editorial articles. In addition, as an added service to readers, a trade literature section with a coupon will be included in each of the eight regular editorial sections.

### Extra Copies Available

Last year many orders for extra copies could not be filled because they were received after publication of the issue. Many executives have felt this issue was so important as a reference that extra copies have been ordered for men who ordinarily read routed copies. FACTORY is glad to cooperate in making extra copies available, but orders must be received in New York not later than September 25th.

IN 45,000 WAYS
TOLEDO WEIGHT CONTROL
GUARDS PROFITS

PERHAPS your problem is different . . . and if it's how to improve your golf game . . . well, maybe we can't help you. BUT if it has to do with *weight control* in any industry, 45,000 chances to 1 Toledo Scales can help you.

Whatever *your* problem in weight control . . . our broad experience and years of engineering research are always at your call. 181 Sales and Service Offices throughout the U. S. and Canada.

TOLEDO SCALES

NO SPRINGS HONEST WEIGHT

NOW READY NEW 3rd EDITION

Send now for the *new* Edition of this most widely used single pictorial reference on modern industrial weighing . . no obligation. TOLEDO SCALE COMPANY, Industrial Scale Department, Toledo, Ohio.

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*Address*_____

*City*_____ *State*_____

3-1 M

# HERE'S HOW

September ★ News About New Developments in Storage and Shop Equipment ★ 1939

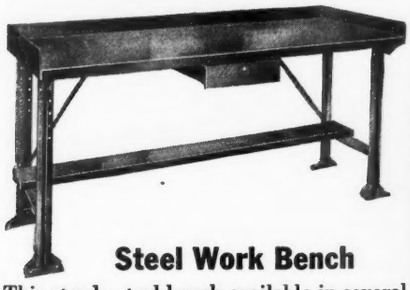

## What's New?

### Portable Tool Stand

Designed to save steps, time and labor . . . and to protect tools against loss and damage . . . this easily moved tool stand will save time on a wide variety of repair, manufacturing and assembling jobs.

Top tray and two shelves permit laying out of tools and parts for most efficient handling. A roomy bench drawer provides auxiliary storage space and extra protection for precision tools.

Strongly made of heavy gauge steel to assure a lifetime of repair-free service. Legs fitted with 2½" casters. Width 20". Depth 28". Height 37".



### Steel Work Bench

This sturdy steel bench available in several standard lengths, and two depths. It is designed to provide maximum working comfort . . . a vital factor in securing maximum output by workmen day in and day out.

Top is one solid sheet of heavy gauge steel, flanged down and back. Top plate flange is punched on 3" centers for attachment of vise block and bench drawer. Back and end stops are 3" high. Roomy bench drawer provides safe, convenient storage for tools—28" or 34" depth provides ample space for efficient work and necessary tools or materials. 34" height permits working with a minimum of muscular fatigue.

### New Steel Bench Legs

Strongly made of heavy gauge steel, these bench legs provide a sturdy, rigid foundation for any type of bench top . . . metal or wood. Both the uprights and cross members are punched for attachment of wood top, shelves, and stringers. Overall height 32½". Width 28" and 34".

### These Shop Boxes Can "Take It"

Day in and day out for five years most of the Lyon Steel Boxes in the accompanying illustration have been subjected to alternate baths of hot water and soda and baking from 45 minutes to 2 hours at temperatures ranging from 800° to 1,000°. In spite of this grueling ordeal, constant handling and stacking when heavily loaded with heavy metal parts, these Lyon Taper Boxes —which are perforated on the sides and bottom—are still in usable condition after five years of continuous service.

## Specific Cost Savings on Materials Handling Determined in Advance by Shop Box Survey

A shop box survey by Lyon Storage Equipment Engineers is much more than a check-up of the amount and condition of existing equipment. It is an accurate inventory of operating conditions . . . permitting a precise estimate of unnecessary operations and hazards. It makes possible a practical estimate of whether and how quickly more efficient Lyon materials handling units will pay for themselves.

An excellent illustration of the effectiveness of such a survey in unearthing opportunities for definite cost savings is provided by a recent check-up made in a plant where the product is subject to periodic changes in design and where no previous costs had ever been set up. In the "Summary of Savings," which is always a part of a Lyon survey, this manufacturer was shown how six types of losses and hazards were increasing costs or endangering profits. These losses or hazards, and their causes were tabulated in our report as follows:

*"1—Production Cost Losses*

A. Delays in receiving material at machine.
B. Material not in proper box for easy handling at machine.
C. No provision of easily handled boxes for moving parts away from machine.
D. Failure to provide proper boxes for handling the material between lines when servicing the assemblers.
E. Inability to stack boxes in use so that they could be safely hauled to Plant No. 2 or sent outside for further work.

*"2—Transportation Cost Losses*

A. Loading and trucking time multiplied because cartons and wooden boxes could not be stacked.

*"3—Storage Space Losses*

A. Much needed floor space made unproductive because boxes in use could not be stacked.
B. Aisles so cluttered up with boxes that movement of men and materials was greatly retarded.

*"4—Fire Hazard*

A. The great number of wood boxes and cartons spread over the floor presented a serious fire hazard. Even a small fire would have resulted in considerable damage to parts stored in such containers.

*"5—Personal Injury Hazard*

A. Where several hundred boxes are spread over a great floor area and block aisles—serious personal injury hazards are automatically set up.

*"6—Damage to Stock*

A. In a two-hour period we saw two boxes of finished parts accidently dumped on the floor. This, of course, subjected the parts to damage in addition to requiring extra time for the workmen to pick them up.

"In considering all the possible savings possible through correction of the conditions disclosed by this survey . . . basing our estimate on the experience of other plants . . . you can conservatively count on cost reductions of $4,000.00 per year when recommended equipment is put into use."


**LYON** *Service*
*STORAGE EQUIPMENT*
**LYON METAL PRODUCTS, INCORPORATED, Aurora, Illinois**

LYON METAL PRODUCTS, INCORPORATED
1209 River Street, Aurora, Illinois

Please send full details on:

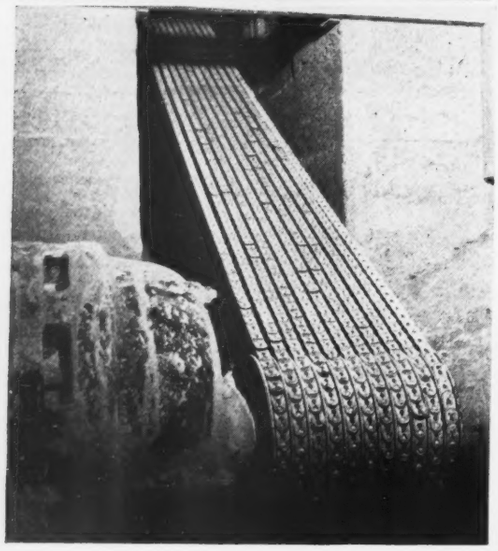
☐ Storage Survey Service ☐ Portable Tool Rack
☐ All-Steel Shop Bench ☐ Shop Bench Legs
☐ Shop Box Catalog

*Name* _____

*Address* _____

*City* _____ *State* _____

"... VEELOS BELTS LASTED 4 TIMES AS LONG AS SOLID BELTS"



THIS plant superintendent (name on request) writes: "Our Veelos Belts have been in actual service for 4 years. Part of the time 24 hours a day—7 days a week. They have proven superior to any other belts we ever used. Veelos Belts lasted 4 times as long as solid belts."

More flexible, more adaptable, easily adjustable, 60-Second* Veelos fits around any drive without machinery teardowns. Longer service is made possible through ability to continuously maintain uniform tension on each strand, thereby preventing costly slippage and shut-downs for replacement.

*60 seconds to uncouple needed length from roll, 60 seconds to couple endless around any drive.

Good distributors all over the country stock Veelos V-Belting. Write for name of nearest distributor.

VEELOS
The 60-Second
V-BELT

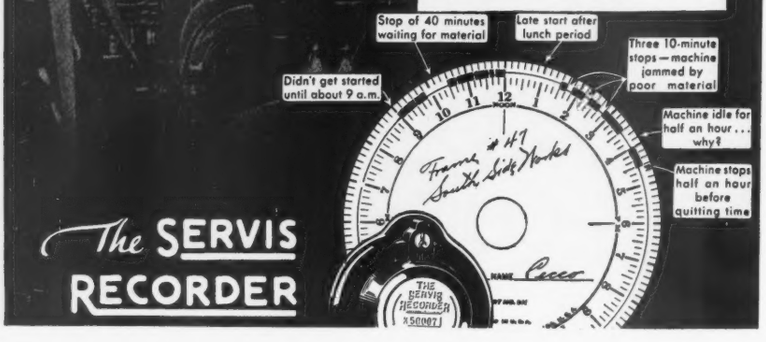
MANHEIM MANUFACTURING & BELTING CO., MANHEIM, PA.

How to Check IDLE TIME of Machinery

Do You Know Exactly How Long Each Machine Stood Idle?

The *Servis Recorder* tells you. See how "time down" stands out on the chart below. You can't miss it. You can't help but reduce it! Suppose you could reduce idle time on all your factory machinery merely 10 minutes a day! What would it amount to in a year—or even a month! More than you'll ever save by "little economies."

The *Servis Recorder* bolts or clamps right on the machine itself—no ink, no pencils, no electric wires. Send for folder. *The Service Recorder Co. 1422 Euclid Avenue, Cleveland, Ohio.*


Stop of 40 minutes waiting for material
Late start after lunch period
Three 10-minute stops—machine jammed by poor material
Didn't get started until about 9 a.m.
Machine idle for half an hour... why?
Machine stops half an hour before quitting time
THE SERVIS RECORDER

The SERVIS RECORDER

At Your Service

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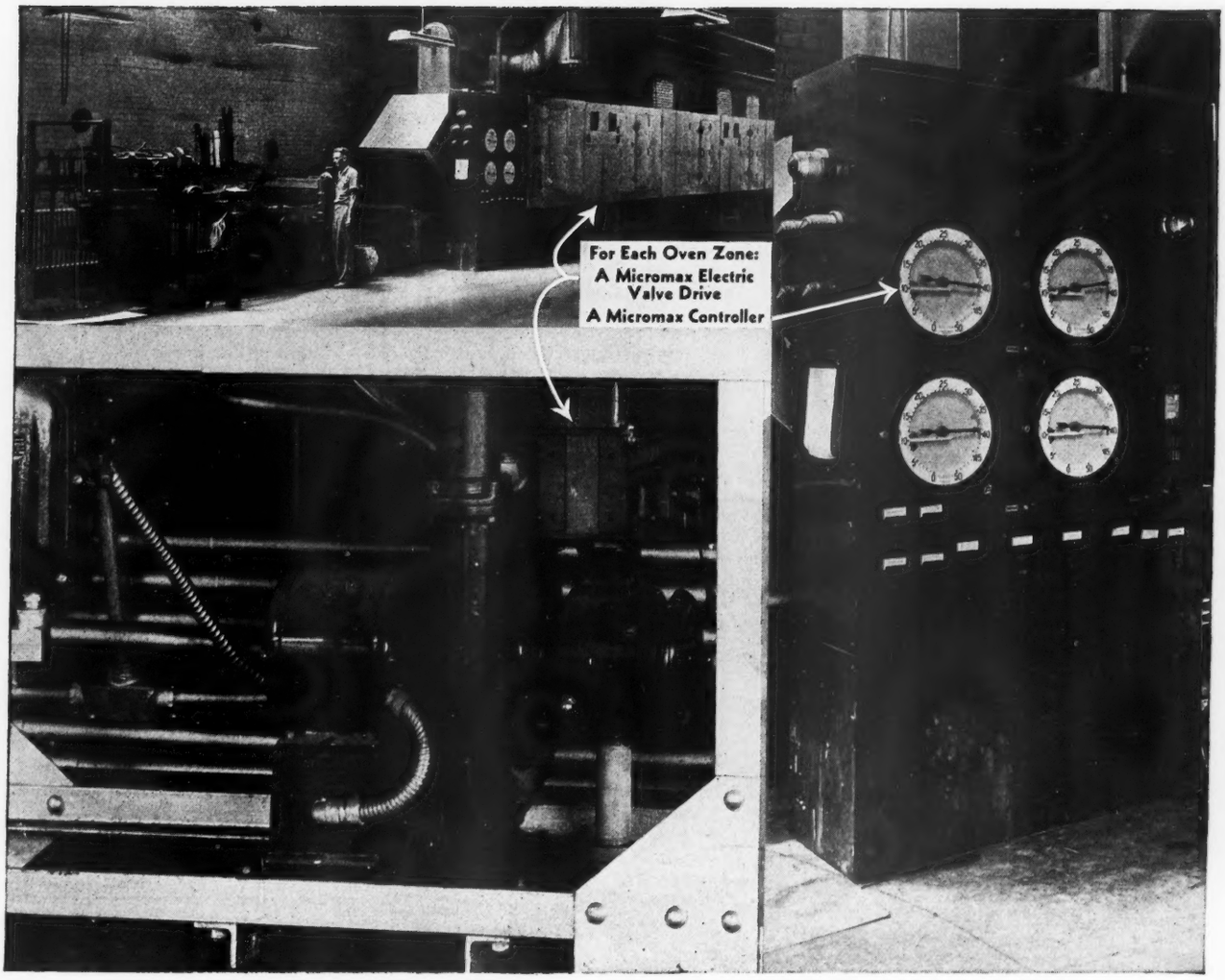


# *One Degree* IS VITAL!

## SO MICROMAX IS IN CHARGE

Because a temperature difference of *only one degree* at the pyrometer may affect the customer's satisfaction in the baking of tricky lithographic lacquers, the company takes no chances with temperature control on their Young Brothers Lacquer Oven. They use full Micromax Electric Control for each of its four Maxon Premix burners . . . instead of a less exact control, checked periodically by a precision portable instrument. They have the precision in the Micromax Pyrometer, and get its full benefits continuously.

The same Micromax equipment could be used, without the addition or removal of a single part, for closest possible control of a hardening pot, open hearth, soaking pit, box furnace or practically any other heat-using equipment. You can standardize on Micromax.

*WRITE FOR CATALOG N-OOA, "MICROMAX ELECTRIC CONTROL"*

**LEEDS & NORTHRUP COMPANY, 4909 STENTON AVE., PHILA., PA.**

**LEEDS & NORTHRUP**

**MEASURING INSTRUMENTS • TELEMETERS • AUTOMATIC CONTROLS • HEAT-TREATING FURNACES**

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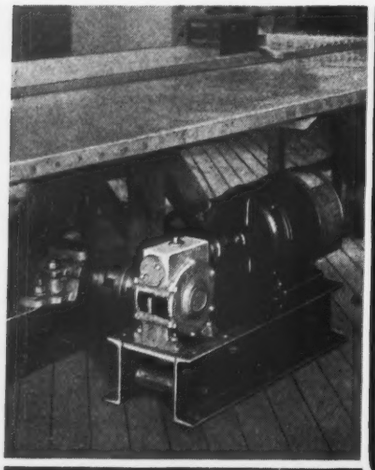
# PLANNING A CONVEYOR INSTALLATION?

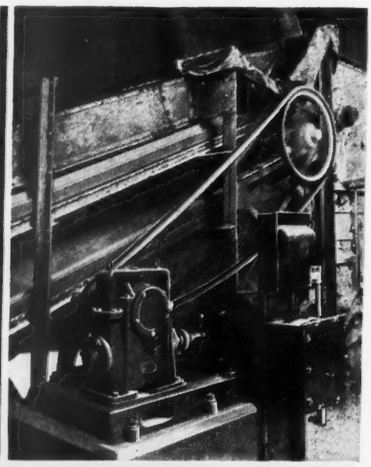


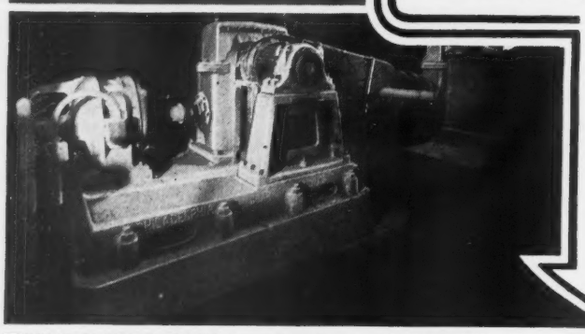
**Be sure it's driven through a**

## PHILADELPHIA
## WORM GEAR SPEED REDUCER

With smooth, steady, dependable operation of a conveyor system depending largely upon the drive selected, it is natural that so many firms choose to drive through Philadelphia Worm Gear Speed Reducers . . . a few typical installations in varied lines of industry are shown here.

Precision cut worm gear and worm, mounted with split hair accuracy on anti-friction bearings and enclosed in cast iron housings with provisions for adequate lubrication . . . that in a few words describes Philadelphia Worm Reducers. Install them with confidence of securing trouble-free operation with maximum of input power delivered. Various styles for your requirements.





Send for a copy of our latest Worm Gear Reducer Catalog.

**PHILADELPHIA GEAR WORKS • ERIE AVE. & G ST., PHILADELPHIA, PA.**

# *What* DO YOU *pay for* PAINT ?

PRICE per gallon is an easy figure to quote, useful only when you know how many square feet a gallon will cover properly, and how long the paint will protect. Figured that way, the cheapest paint is likely to be the most expensive; the most expensive, not necessarily the cheapest.

True economy is measured by the cost of protection per square-foot-year, and that's how Dixon's Silica Graphite Industrial Paints show their superiority.

The very nature of the pigment gives Dixon's an outstanding advantage, for natural flake graphite is chemically inert and moisture repellant. Its thin, flat particles plate the surface with an armor of overlapping scales that adhere with remarkable tenacity. Silica, combined by nature with graphite, hardens and strengthens the coating; while pure, boiled linseed oil cements the whole into a coat that, in almost countless instances, has withstood the elements and industrial gases for periods as long as ten years.

There's true economy in Dixon's Silica Graphite Industrial Paints. Available in fourteen colors including aluminum. Write for Master Specification 44-B1.

***Paint Sales Division***

**JOSEPH DIXON CRUCIBLE CO.**

**Established 1827** D X N **Jersey City, N. J.**

**DIXON'S INDUSTRIAL SILICA-GRAPHITE PAINT**

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If you are on a route list to read Factory Management and Maintenance, you probably pass it along without having the chance to read just the article that you would like best. Routed copies have a knack of arriving at inconvenient times —late—and often in poor condition.

Why not have your own copy delivered to you each month? Then you could read at your leisure—and while the news is still hot. A subscription costs only $3.00 per year. Send in yours now.

FACTORY MANAGEMENT *and* MAINTENANCE

330 West 42nd Street, New York City

# 15 Hoover Cleaner Parts show how to Cut Costs

## WITH BAKELITE MOLDED ASSEMBLIES

HERE IS A typical example of the short-cuts to *better products at lower cost* which you may obtain from Bakelite Molded parts in your assemblies!

When the Hoover Company planned to bring out this year's model 305 — a quality vacuum cleaner at moderate price — the design and assembly benefits of Bakelite Molded played an important part in its successful production.

For example, the manufacturer states that Bakelite Molded permitted use of designs "which would not have been readily adaptable to any material other than plastics." Production was expedited by complete forming of 15 complex parts in single molding operations. Since color and rich lustre are inherent in the material, costly finishing operations were eliminated. And assembly was greatly simplified by many short-cuts like those pictured.

Similar benefits may be open to you through application of Bakelite plastics in your products. More than 2000 different Bakelite materials are available to help you. Write *today* for Portfolio 16 of detailed booklets describing these materials.

Bakelite Corporation, 247 Park Avenue, N.Y.
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**PLASTICS HEADQUARTERS**



**SAVE DRILLING, TAPPING.** Holes for self-tapping screws, and threaded holes for machine screws are completely formed and finished — ready for assembly — when Bakelite plastic parts leave the mold.



**SAVE WELDING.** With Bakelite Molded, this lamp socket is integrally incorporated in the Hoover motor base. Former practice would have called for separate forming and welded assembly.

**SAVE GROOVING, COUNTERBORING.** Finished grooves, counterbores and recesses are completed in the single molding operation that forms this nozzle connection for the Hoover cleaner.

**SAVE SLOTTING.** Both the vertical and horizontal ports in this Bakelite Molded motor housing are completed in the molding operation, without need for further slotting or finishing.

**VISIT THE BAKELITE EXHIBIT, HALL OF INDUSTRIAL SCIENCE, NEW YORK WORLD'S FAIR 1939**

FIRMLY ROOTED IN THE FERTILE SOIL OF EXPERIENCE...

# DeVILBISS INDUSTRIAL SPRAY FINISHING EQUIPMENT

## GIVES YOU YEARS OF PROFIT ASSURANCE IN EVERY PRODUCT FINISHING OPERATION

Modern DeVilbiss Spray Finishing Equipment has been developed from 50 years of spray engineering experience —from years of experience in solving countless product finishing problems. That's why it's ahead in efficient design, quality construction and performance. That's why so many industries have found it profitable to call DeVilbiss.

DeVilbiss experience has developed a complete line of spray finishing equipment for the complete finishing process—from the application of the material to the ventilation of the finishing area. It includes designs to handle products of all sizes and shapes—to spray any material—to fit into any production setup.

Find out what DeVilbiss experience can do to improve your finishing operations. Write for full information today.

THE COMPLETE DeVILBISS LINE CONSISTS OF: Spray finishing equipment . . . Automatic coating machines . . . Tanks for spray materials . . . Spray booths and exhaust fans for vapor and dust elimination . . . Air regulators, cleaners and dusters . . . Air compressors . . . Respirators . . . Specialized hose for paint, air, water, gasoline, welding and pneumatic tools . . . Hose connections . . . Water and oil guns . . . Equipment to prevent offset in printing . . . Paint stripers . . . Medicinal atomizers . . . Perfume atomizers.

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# NOW

*is the time to order your extra copies of*

# NOVEMBER FACTORY

## "Quick Ways To Profit"

**Hundreds of practical, tested ideas that will help you save money on all kinds of plant operations. In order to be sure that every key man has his own personal copy, send orders for extra copies before September 25th. Schedule of prices for extra copies of November FACTORY is as follows:**

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Please enter our order for the special November issue of FACTORY — "Quick Ways To Profit"

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# LINCOLN

## INDUSTRIAL LUBRICATING EQUIPMENT is designed for two types of applications

**1 MAINTENANCE APPLICATIONS**
**Involving the periodic lubrication of bearings and other moving parts of machinery and equipment in the factory, mill, mine, shop or roundhouse.**

**2 PRODUCTION APPLICATIONS**
**Involving the initial lubrication of manufactured products in the course of production or assembly.**

You can eliminate expensive bearing failures, and save time and money, by using Lincoln equipment for periodically greasing the bearings of the machines in your factory.

Lincoln makes a wide range of equipment for the most efficient application of grease lubricants, and you undoubtedly will find our standard units ideally suited for your requirements. A few of the units are shown below.

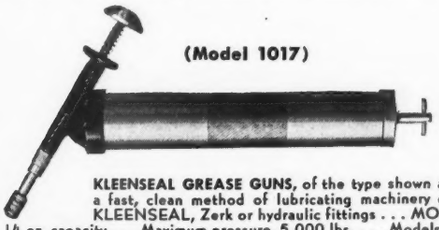
And if you make a product that requires grease lubrication before it leaves your factory—Lincoln makes just the equipment you should have to handle production grease jobs quickly, easily and economically.

**(Model 309)**

**MODEL 309 TWIN CYLINDER AIRLINE LUBRIGUN** (shown above) dispenses lubricant directly from an original 100-lb. drum. This unit is capable of handling semi-solid oils as well as viscous and fibrous greases.

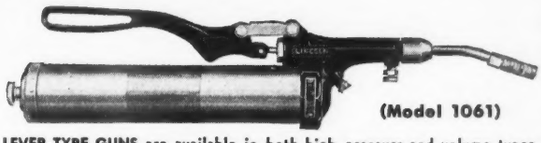
●

Lincoln KLEENSEAL and Button Head Fittings in all types and sizes are available for replacement and modernization needs.



**(Model 1017)**

**KLEENSEAL GREASE GUNS,** of the type shown above, provide a fast, clean method of lubricating machinery equipped with KLEENSEAL, Zerk or hydraulic fittings . . . MODEL 1017 has 14 oz. capacity . . . Maximum pressure, 5,000 lbs. . . . Models also available in 3 . . . 5 . . . 9 and 18 oz. capacity.



**(Model 1061)**

**LEVER-TYPE GUNS** are available in both high pressure and volume types, with attachments for all types of fittings. MODEL 1061 (shown above) handles all types of lubricants and develops pressures up to 10,000 lbs. . . . Capacity 18 ozs.

**MODEL 1730 ELECTRIC LUBRIGUN** is designed for volume requirements; dispenses lubricant direct from original 400-lb. drum.

No matter how large or how small your requirements—it will pay you to obtain details on all items in this complete line . . . Consult your nearest Lincoln distributor or write us for Catalog No. 60.

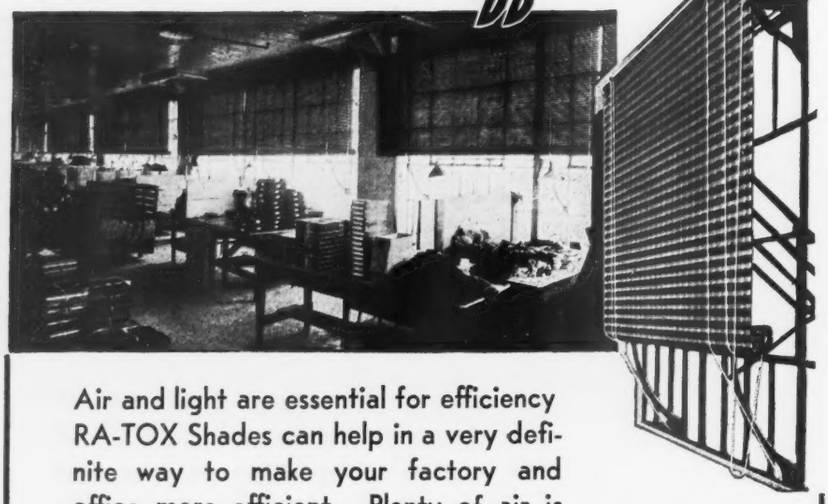
**(Model 1730)**

## LINCOLN ENGINEERING COMPANY

*Pioneer Builders of Engineered Lubricating Equipment*

**ST. LOUIS, MO., U. S. A.**

# RA-TOX FOR *efficiency*



Air and light are essential for efficiency RA-TOX Shades can help in a very definite way to make your factory and office more efficient. Plenty of air is admitted without the danger of direct draft. More work, and better work, can be done under such agreeable conditions, helping to improve the health of your force.

*Made of selected basswood strips, woven parallel with hard twist seine twine; attractive, fast colors add smart, business-like appearance.*

RA-TOX Shades have proved their efficiency in leading factories throughout the country. They are available in narrow splints as well as standard width; square-edge splints and bevel-edge splints; and in three finishes—stain, metallic aluminum, enamel. RA-TOX Shades are for all types of office and factory windows, also monitors and skylights.

## RA-TOX OFFSET WOOD FABRIC SHADES *for* INDUSTRIAL SASH

Write us today and let us show you by word and picture how Ra-Tox Shades have benefited many factories and offices, and how they give service for years and years.

Let us send you illustrated folder describing how to obtain up to 40% more light without draft, thereby increasing the efficiency of workers and the output of your plant.

**HOUGH SHADE CORPPORATION**
**1043 Jackson St., Janesville, Wis.**

**Send complete RA-TOX details at once.**

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☐ Steel Sash ☐ Wood Sash



# Don't Miss

## November FACTORY

## "Quick Ways To Profit"

**Again FACTORY'S Editors, in November will bring you hundreds of tested ideas gathered from the experience of men in many plants . . . ideas that will help you check your own operations and make savings. Completely sectionalized and cross-indexed it will be a reference volume useful to every plant man. Extra copies can be secured if orders are received by September 25th. Schedule of prices for extra copies of November FACTORY is as follows:**

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Title .....

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☐ Purchase Order Enclosed

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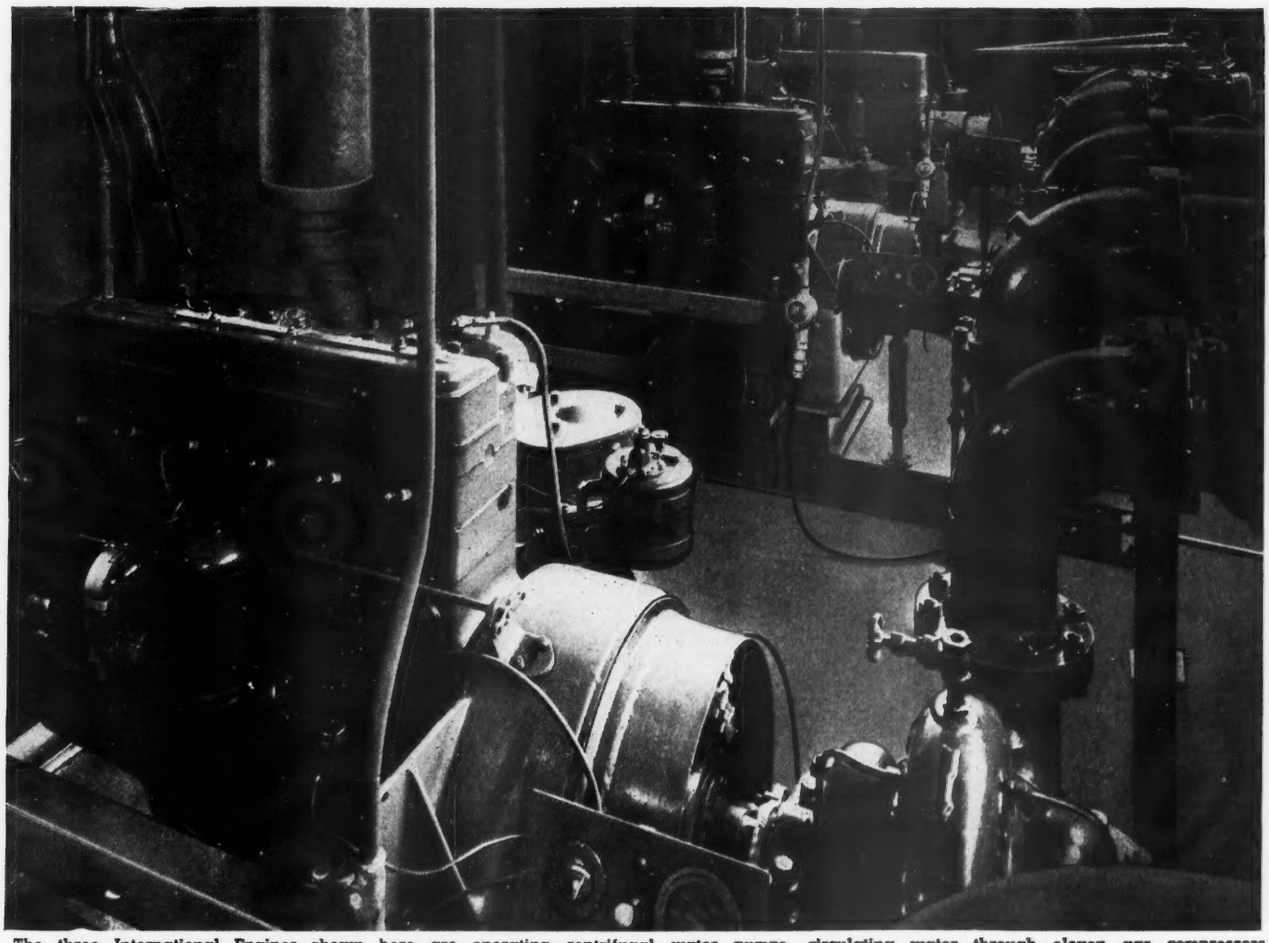
**FACTORY MANAGEMENT AND MAINTENANCE**
**330 West 42nd Street, New York, N.Y.**

# *Quality in Engines*
## Means Profits Through the Years



The three International Engines shown here are operating centrifugal water pumps, circulating water through eleven gas compressors and the cooling tower, in the natural gasoline plant of the Lomita Gasoline Co., Long Beach, Calif. They were installed April 1, 1938. The engines in the rear and foreground are in continuous operation 24 hours a day. The middle engine is a stand-by unit. One pumps 1,200 gallons a minute and the other pumps 1,800 gallons a minute. Fuel used is natural gas obtained from the same line that feeds the compressors.

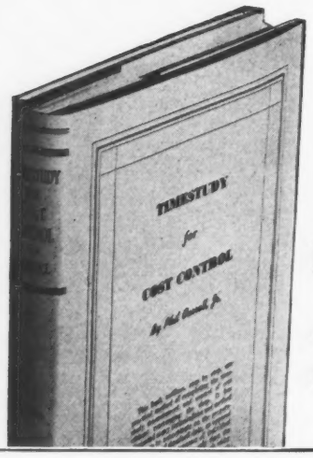
A detailed inspection of International Power Units will show you the *quality* built into these engines. But you have to put them on the job to really appreciate how this quality is converted into low costs, dependability, and long life.

In this famous International line, you will find the power you need . . . the versatility of Internationals makes them readily adaptable to a wide range of work.

There are 11 different models of International Engines, ranging up to 110 max. h.p., for gasoline, Diesel, gas, and distillate operation. When additional power is needed, two or more can be installed and cut in or out as power demands vary. See the nearby International industrial power dealer or Company-owned branch for details.

**INTERNATIONAL HARVESTER COMPANY**
*(Incorporated)*
**180 North Michigan Avenue Chicago, Illinois**

# INTERNATIONAL Industrial Power




**How to make timestudies and how to use them**

To lower costs and improve managerial control

*JUST PUBLISHED*

# Timestudy *for* Cost Control

**By PHIL CARROLL, JR.**
*Vice-President, Dyer Engineers, Inc.*
**305 pages, illustrated, $3.00**

THIS book outlines step by step one practical method of completing the timestudy measurement and control of cost without rearranging the shop. It has eliminated many technicalities and method variations to concentrate on the preparation and use of standard data, as opposed to the very costly process of individual operation timestudy. Not only does the method described permit of a much wider field of application, but the author shows wherein it logically extends beyond simple incentive to form the basis for many managerial controls.

## *You will want to look up in this book*

—the fundamental information on the installation of timestudy for cost control;
—the description of the work involved;
—the type of personnel fitted for it, departmental organization;
—the expert information on how to make comparison sheets, how to handle setup time, how to handle variables, etc., etc.
—the application of these methods to many departments of business.

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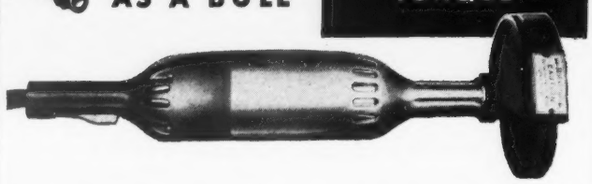
**THE GRINDER WITH THE EXTRA HIGH PULL-OUT TORQUE**



Grinders are no better than the motors that drive them. You can get no more work out of them than the motor can deliver. Sawyer Grinders have the famous Sawyer Hi-Power Motors. These patented motors have highest pull-out torques. This means you can crowd them without harm to the motor. Equally important is weight—Sawyer Hi-Power Motors weigh about half as much, horsepower-for-horsepower, as do ordinary electric motors. Any workman can produce more results with a Sawyer Grinder because it tires him less and can do more for him.

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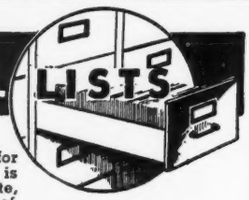

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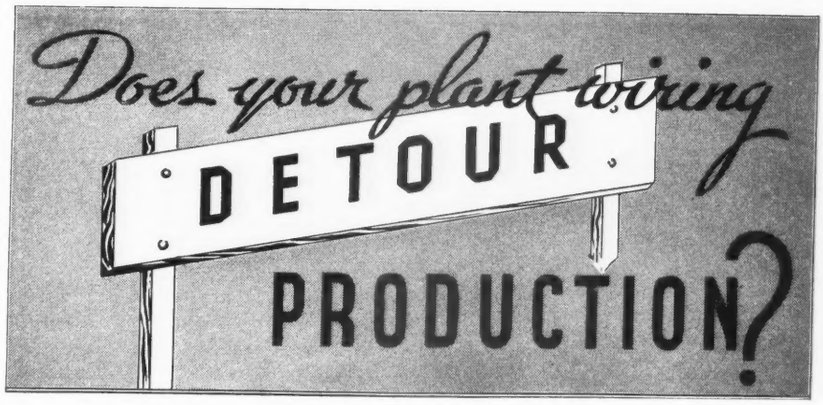


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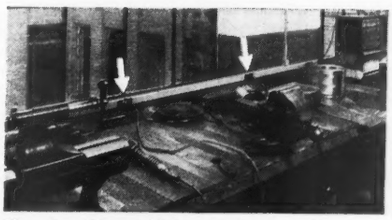
to every department in your plant . . .



Showing Plugmold installation bringing convenient electrical outlets for easy accessibility to bench equipment.

Photograph shows installation of Wiremold Overfloor Wiring System in a factory.

YOUR work flow-chart is planned so that traffic moves swiftly and lost motion is cut to a minimum — so that all operations are synchronized.

An important part of plant planning is direct and efficient delivery of electrical current to all locations where outlets are needed.

Wiremold Systems accomplish this with a minimum of expense and without in any way interrupting plant routine or production—because Wiremold Surface Wiring Systems can be installed by the competent wireman without tearing into walls or ceiling or making other costly structural changes. Wiremold Systems, especially Plugmold-type, make it possible to plug in anywhere. It's easy to change positions of plugs, add new plugs, or make extensions or changes at any time.

With Wiremold you can finally eliminate the costly inconvenience of remote outlets and the hazardous long extension cord from your work benches and shop floors.

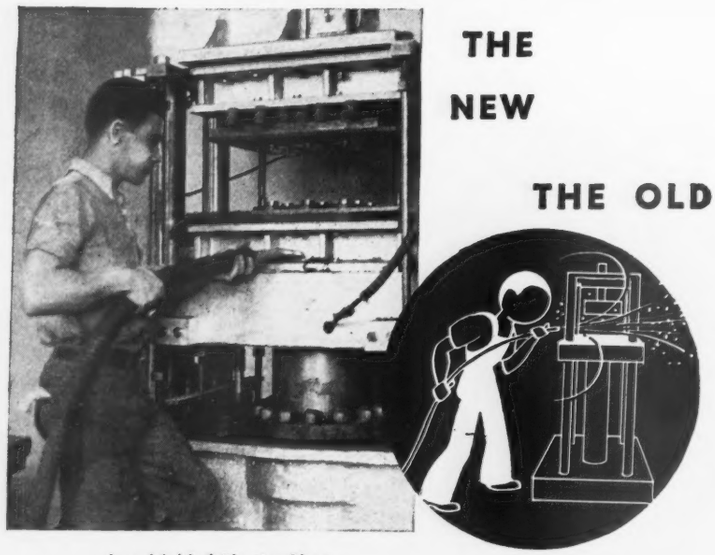
Factory lighting with Wiremold Fluorescent Strip

To get the most profitable use of the current you buy, "Get to know Wiremold". Write for more details today.
THE WIREMOLD CO. - HARTFORD, CONN.

ADEQUATE WIRING SERVES AND SAVES

Get to know WIREMOLD

Quick Service through Electrical Contractors everywhere




In a Molded Plastics Plant

# *You can't kick dust around*

## AND EXPECT TO MAKE TOP PROFITS

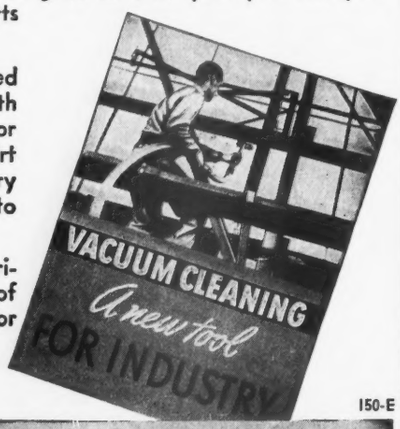
Whether you blow it, shove it with a broom, or just plain kick it around under foot, dirt and dust will get back at you in the profit and loss column sooner or later. The strange thing about it is that a powerful vacuum cleaning system will immediately and forever remove it to containers in the basement at less cost than any combination of hand methods.

In fact, there are many spots in the plant where hand cleaning is either impossible or too expensive to even consider.

***For instance,*** have you ever seen men try to remove cotton, solder, silica sand or soapstone dust by hand? Can you picture a worker trying to retrieve gold, babbitt, rubber or any other valuable material from the litter on the floor? These are only a few of the added dividends that the Spencer Vacuum System provides. And withal it cleans large areas quickly, more thoroughly and at less cost. It places plant house cleaning on a continuous production basis, on a fixed schedule with a known result, a known time, and a known cost. Floors, ceilings, walls and overhead pipes constitute a constant source of fine dust which is dislodged by vibration and breezes, and which goes all over your product, your men, and even into the most delicate parts of your machinery.

*The ultimate* is a stationary system piped throughout the plant, but you can begin with a heavy duty portable as small as ¾ H.P. or as big as 7½ H.P., with a 7½ cubic foot dirt capacity. These with the Spencer Stationary Systems up to 100 H.P. provide a selection to fit your problem and your pocketbook.

Spencer Bulletin No. 120F gives the experiences of others and a complete description of the equipment and tools. Why not write for it now?




150-E

**SPENCER** HARTFORD — CENTRAL AND PORTABLE VACUUM CLEANING SYSTEMS

**THE SPENCER TURBINE COMPANY, HARTFORD, CONN.**

# Idle Surplus Equipment is a DOUBLE Expense

—it represents both inactive capital and wasted space.

—it generally depreciates in value with age.

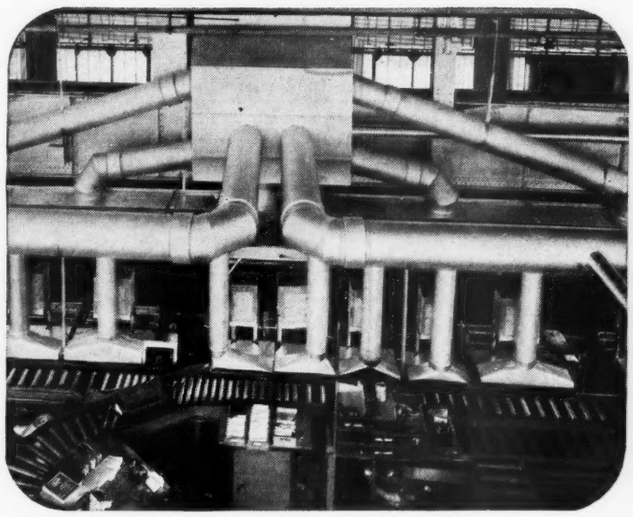
## Sell the equipment you have no further use for — NOW!

Other readers of "Factory" may want just what you no longer need. You can bring your surplus equipment to their attention — at small cost — through advertising in the

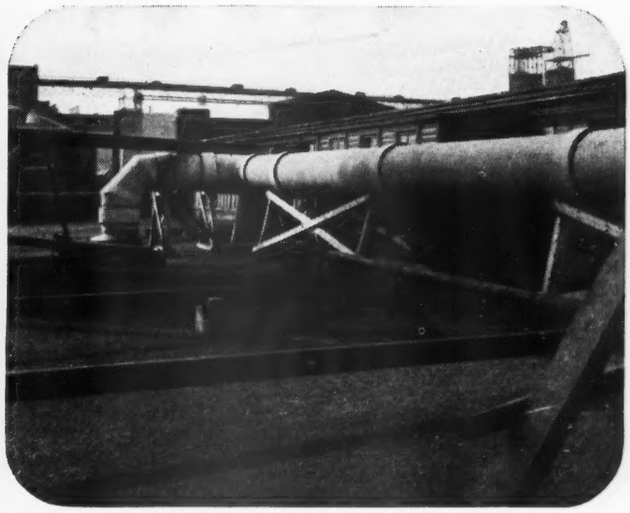
## SEARCHLIGHT SECTION of "FACTORY"

The recognized centre for the advertising of Employment, Equipment and Business Opportunities in manufacturing plants. See the Searchlight Section of this issue.

# LET J-M TRANSITE "S" PIPE Solve Your Venting Problems...



**PROCESS FUMES ARE HANDLED ECONOMICALLY** in this Transite "S" Pipe system. Note the wide range of sizes used here. Installation was rapid, because Transite Pipe is supplied in a size for every requirement . . . and fittings are available to solve every construction problem.



**FOR FIVE YEARS** this J-M Transite "S" Pipe line has withstood $CO_2$ on the inside, weather on the outside. Made of asbestos and cement, this durable pipe offers exceptional resistance to most types of corrosive fumes and gases . . . keeps maintenance costs low, efficiency high throughout the years.

## This asbestos-cement duct has proved to be the ideal material for venting a wide variety of industrial fumes, gases, vapors and dust

PLANNING a new ventilating system? Replacing or extending your existing ducts? You'll be interested in this modern vent pipe that is setting new records for long life and efficient, economical service in many leading plants throughout the country.

This material—J-M Transite "S" Pipe—is made of asbestos and cement. Built up under tremendous pressure on a polished steel mandrel, it is uniformly strong, durable and highly resistant to most corrosive fumes and gases commonly vented at high temperatures.

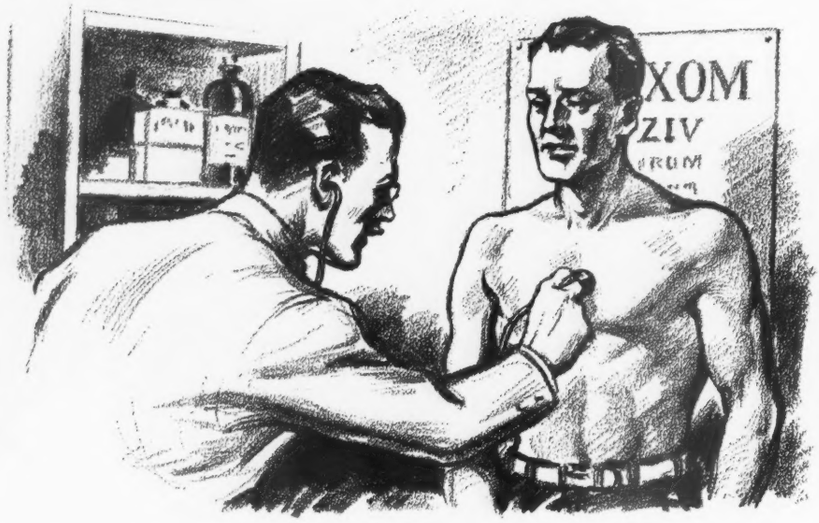
Furthermore, Transite's long, light lengths, ease of assembly and the complete line of fittings available make installation a faster, easier, more economical job . . . even in restricted working quarters. Yet, with all these advantages, the cost of Transite "S" Pipe is surprisingly low. For full details, write for Engineering Brochure DS-336. Address Johns-Manville, 22 East 40th Street, New York, N. Y.

**OUTDOORS,** the asbestos-cement composition of J-M Transite "S" Pipe also provides important advantages. It is highly weather-resistant . . . and its low heat conductivity keeps stack temperatures high for long distances. Draft is greatly improved, condensation is minimized.

# Johns-Manville TRANSITE "S" PIPE

## For permanent, low-cost industrial venting systems

# YES, DOC, THOSE FUMES PROBABLY DID IT!




**"But it can't happen any more in our department. We've got a new fume removal system now."**

(Photo courtesy of Pangborn)

THIS health factor in dust and fume removal is one that no plant can afford to overlook. Not only from an employee relations standpoint but on an efficiency basis as well.

Consider what a Sturtevant Fume and Dust Removal System offers you: — 1. a system exactly suited to your specific requirements, 2. assurance that the hazard will be effectually remedied, 3. the advantages of low power consumption and space economy, 4. savings on your cleaning and maintenance problems.

Let us put 75 years of air engineering experience to work on your dust, fume, steam or excess heat problem. Write, giving brief details.

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Hyde Park, BOSTON, MASS. *Branches in 40 Cities*
B. F. Sturtevant Company of Canada, Ltd.
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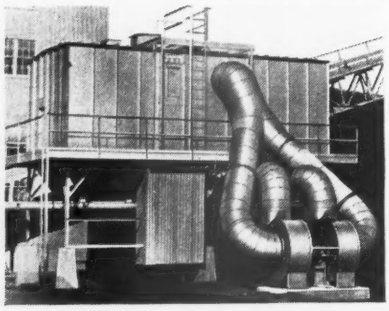
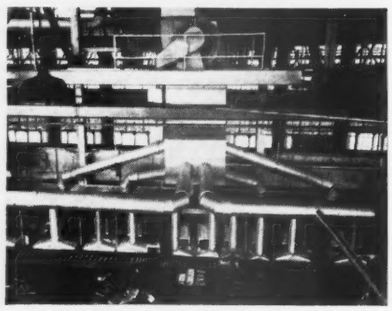


Sturtevant Exhauster for removing dust formed in the manufacture of roofing material at Staso Milling Co., Bound Brook, N. J.



Sturtevant Fan exhausting fumes from pickling tanks in the plant of a prominent electrical manufacturer.

**Sturtevant**
REG. U. S. PAT. OFF.
*Puts Air to Work*

**FOR DUST AND FUME REMOVAL**



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with its resultant waste, plays havoc with production costs.

## PROFITABLE OPERATION

is dependent upon correct plant design, management, processes, equipment and methods.

## ADVICE

available through a CONSULTING ENGINEER is frequently the only necessary means of putting a plant on a more efficient production basis.

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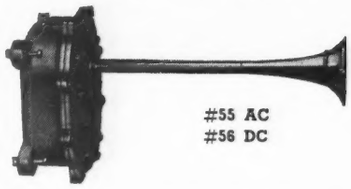

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**installed at a crucial spot can frequently remove the "bugs" from an entire process.**

It's the faster and surer electrical and mechanical "helps" and "hazard removers" that reduce costs and save company money.

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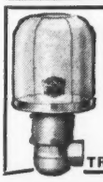

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For maintaining a constant level of oil in ring or ball bearings, pump and gear housings, etc.
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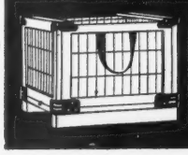

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Hundreds of variations—to suit your needs—with stock sizes of racks, bins and hoppers.

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FOR FUSE CLIPS
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A Complete Line of Industrial Petroleum Lubricants

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Tools for efficient maintenance... the WESTON Clamp-Ammeter and the Junior Voltmeter.

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Weston Electrical Instrument Corp.,
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Send literature on the WESTON AC Clamp Ammeter.

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## November FACTORY

## "Quick Ways To Profit"

**Again FACTORY'S Editors, in November will bring you hundreds of tested ideas gathered from the experience of men in many plants . . . ideas that will help you check your own operations and make savings. Completely sectionalized and cross-indexed it will be a reference volume useful to every plant man. Extra copies can be secured if orders are received by September 25th. Schedule of prices for extra copies of November FACTORY is as follows:**

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**We Rewind, Repair and Redesign all Makes and Sizes**

**ALL TRANSFORMERS GUARANTEED FOR ONE YEAR**

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2 ea. K. D. open top **Steel Tanks,** cap. 80,000 gal.
**Large lot** of 6″, 8″ and 10″ **Stoneware Acid Pipe.**
1—**Gas Meter,** range from 1000 to 1,000,000,000 cu. ft. for natural gas.
6 ea. Motor driven #300 **DeLaval Centrifugal Oil Purifier.**
1—**Vertical Discharge Bucket Elevator,** rubber belt with buckets, approx. 50′ high, 24″ wide, 1″ thick belt, complete with all gearing and casings.
2—150 H.P. **Westinghouse** 25 cyl. 440 volt **Motors.**

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8 ea.—Assorted sizes **Nash Low Pressure Blowers.**
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4 ea.—D. A. **Hard Rubber Pumps** sizes 1½″ by 2″ mfgr'd by American Hard Rubber Pump Co.
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2 ea.—**Worthington** Steam Driven **Vacuum Pumps,** 1220 cu. ft., 5#.
2 ea. 1½″x2″ **Durion Pumps.**

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1—**Worthington** steam driven, 980 cu. ft. 70# to 80#.

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*(See also "Representative Available")*

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Twenty years exceptional experience cost reduction, control, systems, installation, labor relations, all phases modern factory management. Technical education and practical shop experience. Now engaged as works manager. Age 41. Married. Available about Nov. 1st.
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**RA-584,** Factory Manage. & Maintenance
330 W. 42nd St., New York City

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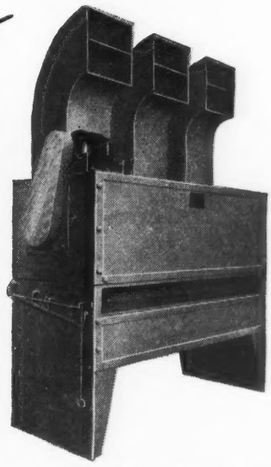
# 3 WAYS TO CUT HEATING COSTS!



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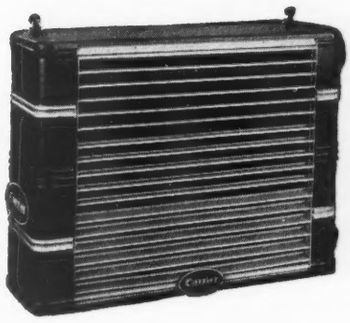

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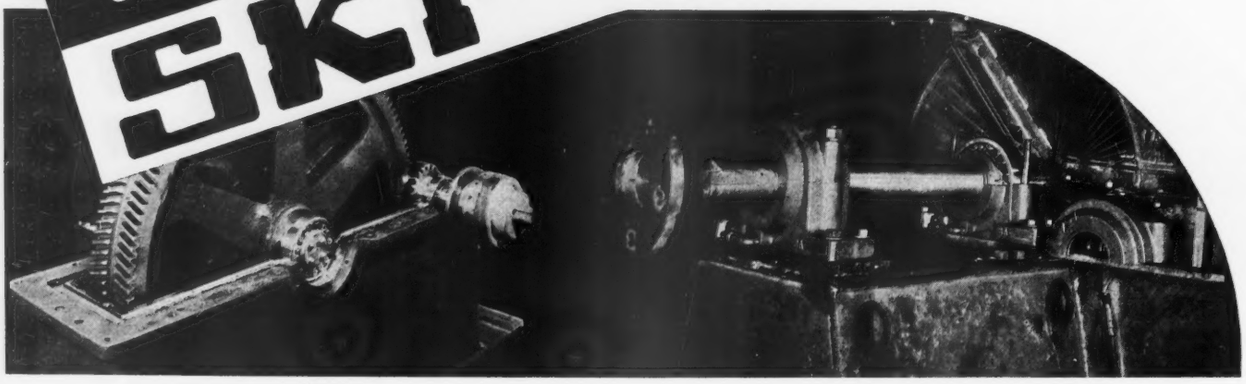

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